USER GUIDE

FM-1000™ Integrated Display

Version 4.00
Revision A
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Agriculture Business Area

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Responsible Party:

Trimble Navigation

935 Stewart Drive

Sunnyvale CA 94085

Telephone: 1-408 481 8000

Canada

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This apparatus complies with Canadian RSS-GEN, RSS-310, RSS-210, and RSS-119.

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Meerheide 45
5521 DZ Eersel, NL

Safety

Always follow the instructions that accompany a Warning or Caution. The information they provide is intended to minimize the risk of personal injury and/or damage to property. In particular, observe safety instructions that are presented in the following format:

WARNING – This alert warns of a potential hazard which, if not avoided, can cause severe injury.

CAUTION – This alert warns of a hazard or unsafe practice which, if not avoided, can cause injury or damage.

Note – An absence of specific alerts does not mean that there are no safety risks involved.

Warnings

WARNING – Incorrect adjustment of the Manual Override Sensitivity calibration setting could cause this critical safety feature to fail, resulting in personal injury or damage to the vehicle. Any adjustment to this setting should only be made by an experienced user.

WARNING – During the Deadzone calibration, the system moves the vehicle's steering wheels. To avoid injury, be prepared for sudden vehicle movement.

WARNING – When you tap the liquid flow calibration **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

WARNING – When you tap the control valve calibration **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

WARNING – When you tap the fill disk **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

WARNING – When the implement is down and the master switch is in the On position, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

WARNING – The display contains a single-use Lithium-sulfide LiSO2 battery. Do not expose the battery to temperatures greater than 71 °C (160 °F) as the battery may explode.

Contents

CHAPTER

1

Introduction

This manual describes how to install, configure, and use the available plugins for the Trimble® FM-1000™ integrated display version 4.00.

Even if you have used other Global Positioning System (GPS) products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product. If you are not familiar with GPS, visit the Trimble website (www.trimble.com) for an interactive look at Trimble and GPS.

About the product

The FM-1000 integrated display, which consists of both software and hardware, is an easy-to-use advanced field management system. The software runs on a 30 cm (12") touch-sensitive, color LCD screen.

The FM-1000 integrated display is the company's highest level display for agricultural purposes.

It is compatible with the Autopilot™ automated steering system. For several years, the Autopilot system has been the company's most accurate system for agricultural guidance. Now, with the FM-1000 integrated display, that same accuracy can be controlled with a touch-screen interface to provide easy, precise, and reliable steering.

With the additions to the software in version 4.00 you can use the FM-1000 integrated display to perform many other functions, including implement guidance or field leveling.

Using this manual

The FM-1000 integrated display uses segments of product functionality called ***plugins*** to add or remove display options.

This manual contains a description of all the plugins, however, it is unlikely that you will use all of the plugins.

Related information

Sources of related information include the following:

- Release notes – The release notes describe new features of the product, information not included in the manuals, and any changes to the manuals. The release notes are available at www.trimble.com.
- Training courses – Consider a training course to help you use your GPS system to its fullest potential. For more information, go to the Trimble website at www.trimble.com/training.html.

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, ***contact your local reseller***.

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2. Click the **Support** button at the top of the screen. The Support A–Z list of products appears.
3. Scroll to the bottom of the list.
4. Click the **submit an inquiry** link. A form appears.
5. Complete the form and then click **Send**.

Alternatively, you can send an email to trimble_support@trimble.com

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CHAPTER

2

Display Overview

In this chapter:

- System components
- Using the FM-1000 integrated display
- Installing the display
- Connecting the display
- Inserting a memory stick into the USB socket
- External Lightbar/s

The FM-1000 integrated display is a touch-sensitive screen that runs field management software.

This chapter introduces the FM-1000 integrated display and some of the basic operations.

Also covered is the usage of the FM-1000 integrated display's mapping and guidance features. The chapter explains how to set up and use the field features, and how to perform steering navigation.

System components

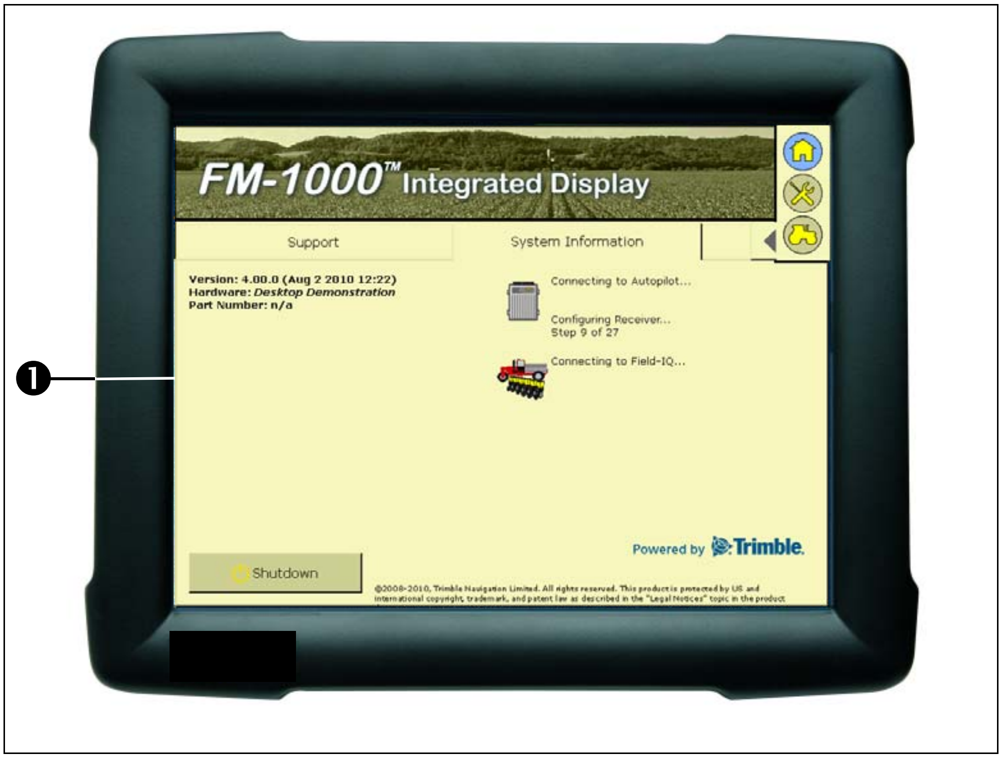
Pack-out contents

The box contains the following components:

- The FM-1000 integrated display
- The mount bracket and screws.
- GNSS antenna
- GNSS antenna mounting plate
- Power cables
- Quick reference card
- Documentation CD
- Radio antenna (RTK only)

Item	Description
❶	FM-1000 integrated display
❷	RAM mount and screws

Front view



Item	Description
❶	Touch-sensitive screen

Touch-sensitive screen

The FM-1000 integrated display has a 12" touch-sensitive screen. In the field, the easiest way to interact with the system is to tap the screen with your finger.

CAUTION – Do not press on the screen with a sharp item, such as a pencil; you may damage the surface of the screen.

Rear view

Item	Description
❶	Power button
❷	Brightness controls
❸	USB socket
❹	Backup battery housing
❺	Power connection socket
❻	Primary GPS connector
❼	Secondary GPS connector
❽	RTK antenna connector
❾	CAN communication sockets (A / B)
❿	Serial communication sockets (C / D)

Power button

To turn the display on or off, press and hold the power button for approximately 0.5 seconds.

Brightness controls

To increase or decrease the brightness of the FM-1000 integrated display, press the corresponding button.

USB socket

You can connect a USB memory stick to the display to transfer of data to and from the unit.

Power connection socket

Connects the power cable (P/N 66694) to the display.

Primary / secondary GPS connector

Connects the GPS cable (P/N 50449) to the display.

RTK connector

Connects the RTK cable (P/N 62120) to the display.

Serial / CAN sockets

Connects external devices to the display. For example, you can use these sockets to attach devices like AgCam cameras, or the EZ-Boom® automated application control systems.

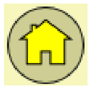
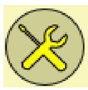
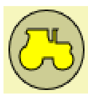
System software

The FM-1000 integrated display includes the following features:

- Field definition and mapping
- Feature mapping
- Guidance to predefined field patterns
- Logging of coverage data
- Variable rate control
- Boom/Row switching
- Logging of topographic mapping data
- Output of information for analysis in office-based Geographic Information System (GIS) software
- Seed, Liquid, Granular, and Anhydrous Ammonia control
- Seed monitoring

Control buttons

On the display's Home screen, there are three touch-sensitive buttons on the right side:

Press this button…	To…
	access the Home screen (see page 32)
	access the *Configuration* screen (see page 33) via the *Current Configurations* screen
	access the Run screen (see page 34) via the *Configuration Selection* screen

For more information, see Home screen, page 32.

Touch screen elements

The following interactive features appear on the touch screen:

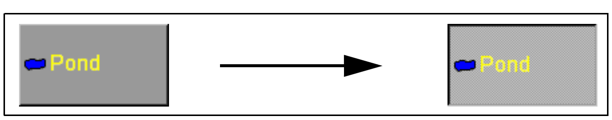
- Virtual buttons
- Virtual keyboard
- Virtual number pad
- Drop-down boxes
- Slider bars
- Lists

For more information, see Slide-out tabs in Configuring the Status Items, page 88.

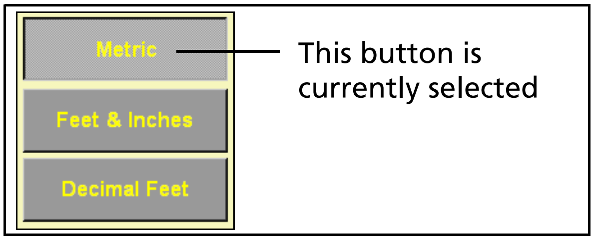
Virtual buttons

The most common way to interact with the display is to use the virtual buttons.

Treat a virtual button as you would a normal button. To "press" the button, tap the area of the screen where it appears:

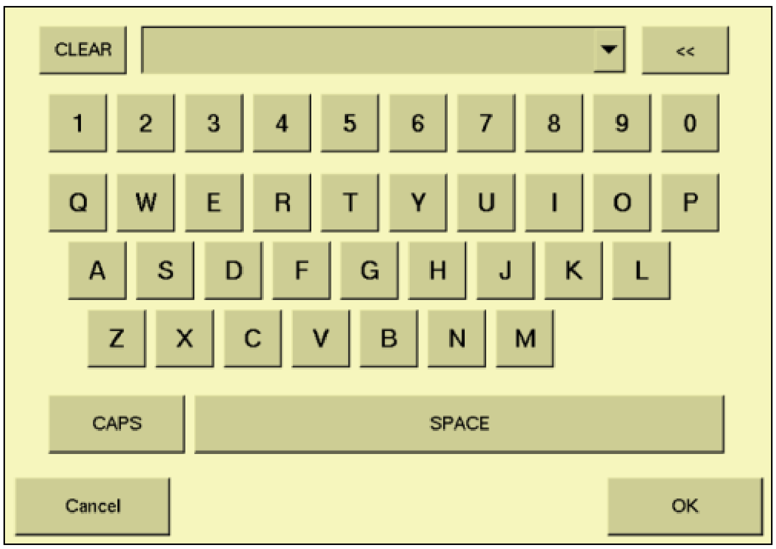


Some FM-1000 integrated display buttons have a direct action, while others change to show that a feature is enabled or disabled:



Virtual keyboard

Use the virtual keyboard to enter text and numbers:

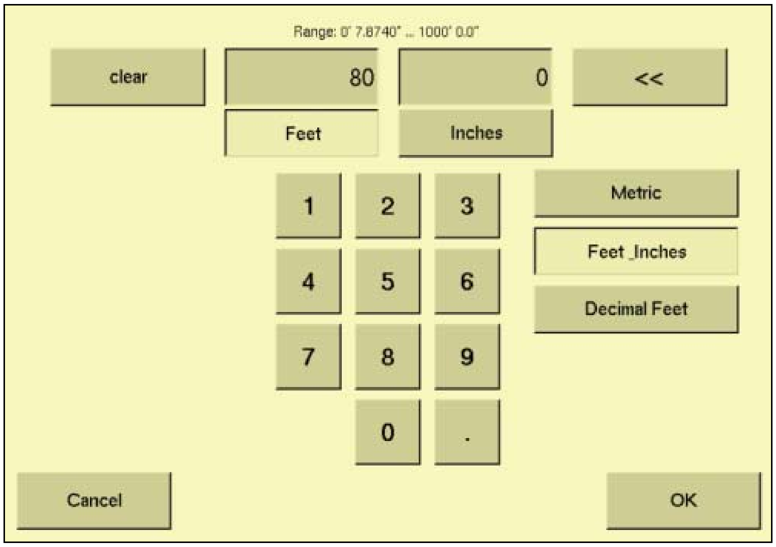


To...	Tap...
enter a letter or number	the appropriate button
enter caps mode	the **CAPS** button
leave caps mode	the **CAPS** button again
erase a letter that you have typed by mistake	the **<<** (backspace) button
clear all the text you have entered	the **CLEAR** button
finish entering text	the **OK** button

Virtual number pad

The virtual number pad works in the same way as the virtual keyboard.

For example, the following screen appears when you edit the width of an implement in the *Implement Boom Setup* screen:

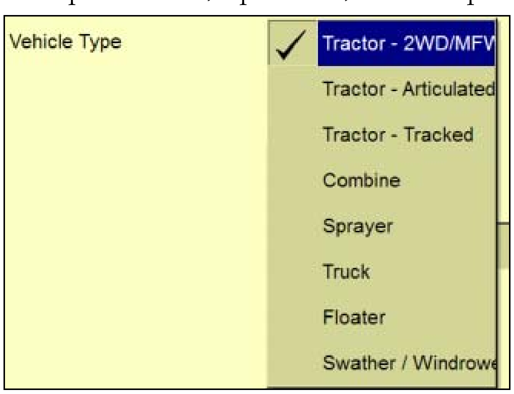


Select the **Metric, Feet & Inches**, or **Decimal Feet** button to change the units.

Tip – When you change units, the number value in the window is automatically converted to the new unit, so select the correct units ***before*** you enter a number value.

Drop-down boxes

A drop-down box, if provided, lists the options you can select from the current list:



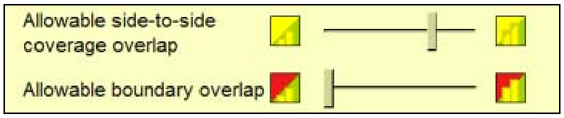
To select an item:

1. Tap the list once to open the drop-down list.
2. Tap the required item from the list.

The drop-down list disappears and the selected item appears in the field.

Slider bars

Slider bars appear on several of the configuration screens:



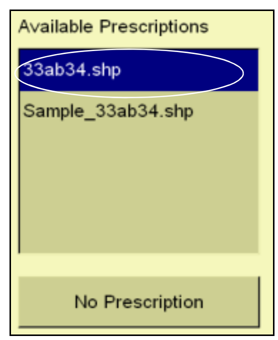
A slider bar shows how extreme a selection is. If you use a slider bar to select the value, it is apparent that you are nearing the extreme value.

There are two ways to use a slider bar:

- To move up by one increment, tap on the slider bar in the direction that you want to move the pointer.
- To slide the pointer:
  a. Touch the screen where the pointer is located and hold your finger on the screen.
  b. Move your finger along the axis, in the direction that you want to move the pointer.
  c. Remove your finger when you are satisfied with the position of the pointer.

Lists

A list shows all the available options. To select an item from a list, tap the item.



Folder hierarchy

The FM-1000 integrated display stores data in a folder hierarchy according to client, farm, field, and event.

Item	Description
Client	The customer for whom the work is being done
Farm	A collection of fields (see below)

Item	Description
Field	A specific area of land where events are carried out. A “field” can be created on the display to represent an actual field, part of an actual field, or a group of more than one actual fields.
Event	A precision agriculture application or activity on a particular field (see above). For example: - Planting of seed - Application of fertilizer or lime - Spraying with fungicide, herbicide, or insecticide

Each client may have several farms, each of the farms may consist of several fields, and each field may be broken into a number of events.

Using the FM-1000 integrated display

Turning on the display

Briefly hold down the power button (for approximately half a second). The display turns on, and after a pause the Home screen appears.

The FM-1000 integrated display has three main screens:

- Home screen
- *Configuration* screen
- Run screen

To access each of these screens, tap the appropriate button on the right of the display. For more information, see Control buttons, page 26.

Turning off the display

Note – *Close all fields before you turn off the system. To close a field, see* *Closing a field, page 48*.

There are several ways to turn off the display:

- Return to the Home screen and then tap **Shutdown**.
- Hold down the power button (on the reverse of the display) for approximately half a second.

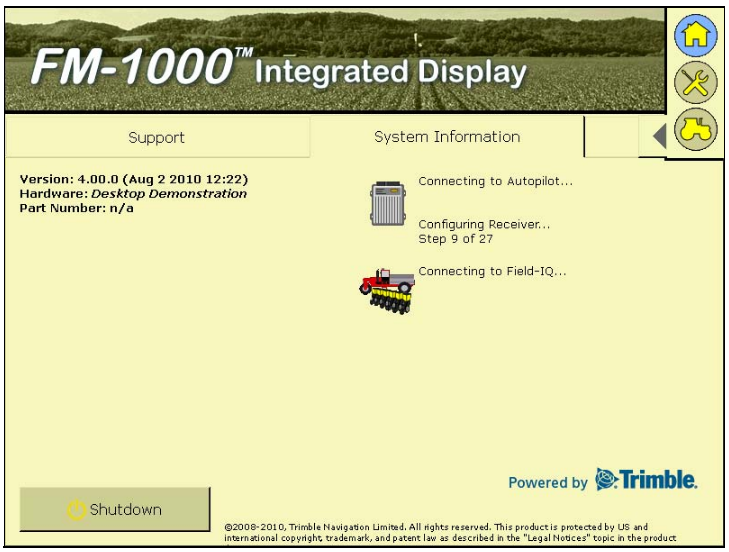
Note – *There is sometimes a short delay between the time when you tap the power button and when the display turns off. This is because the display is saving settings.*

Home screen

The Home screen lists the following information about the display:

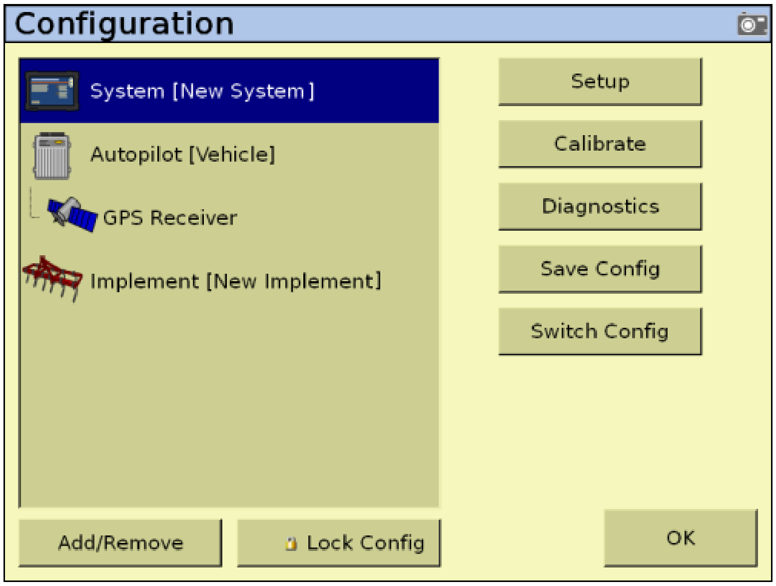
- The display build date, firmware, and hardware version.
- The Autopilot controller version, date, and serial number.
- The GPS receiver version, correction source, and subscription information.
- The selected vehicle make and model.

***Note –** If you connect **two** Autopilot NavController II controllers, the Home screen shows a summary of both controllers. If you connect a single controller, the Home screen appears as shown below:*



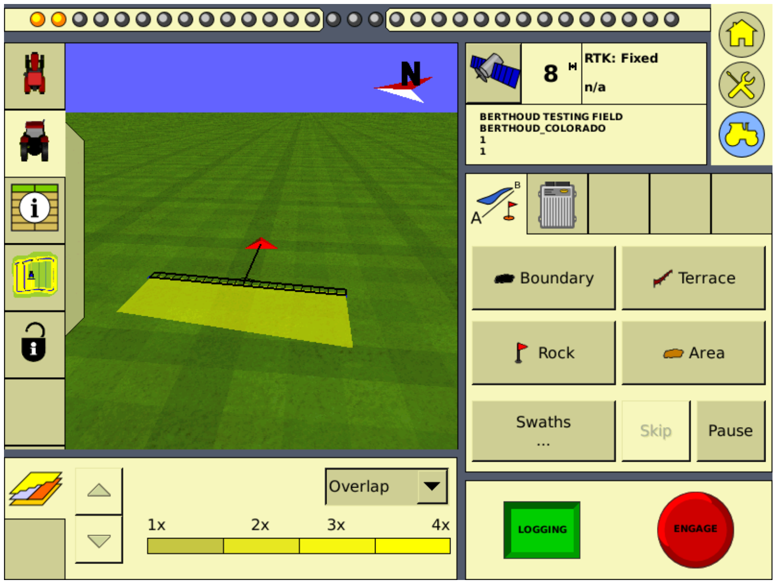
Configuration screen

The *Configuration* screen enables you to create, edit, and save various editable system settings, and add or remove system options. For more information on using the Configuration screen, see Accessing the system configuration settings, page 80.



***Note** – Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the Home button. When prompted to close the field, tap **Yes**.*

Run screen

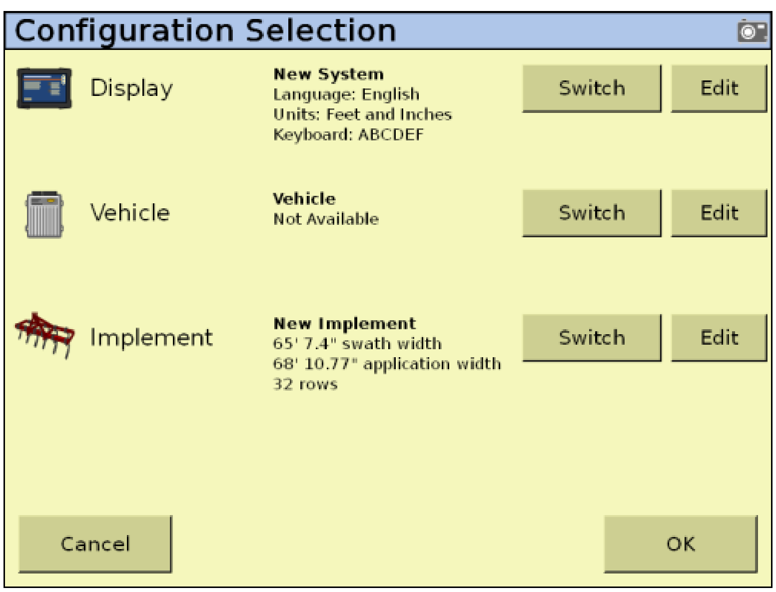


The Run screen shows the steering navigation. If you select the Run screen and you have a field open, the display shows that field. If you select the Run screen when there is no field open, the *Field Selection* screen appears.

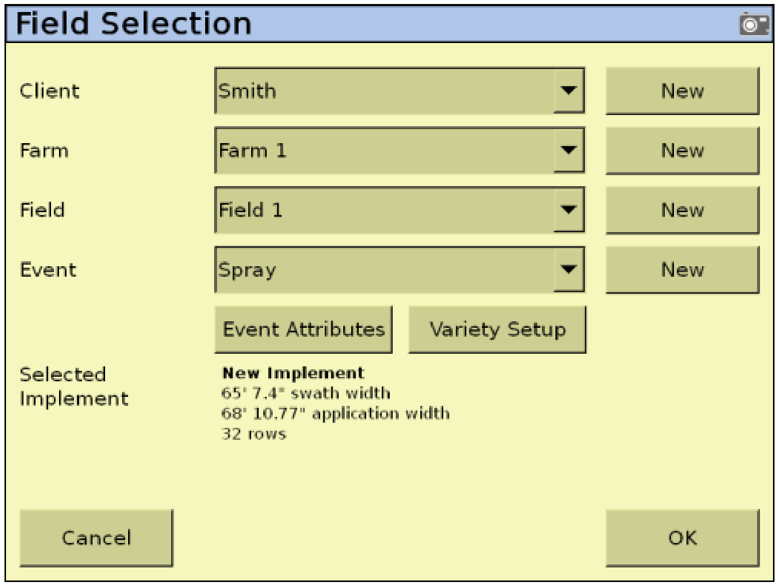
Accessing the Run screen

To access the Run screen, do the following:

1. From the Home screen, tap .



2. From the *Configuration Selection* screen, tap **OK**.



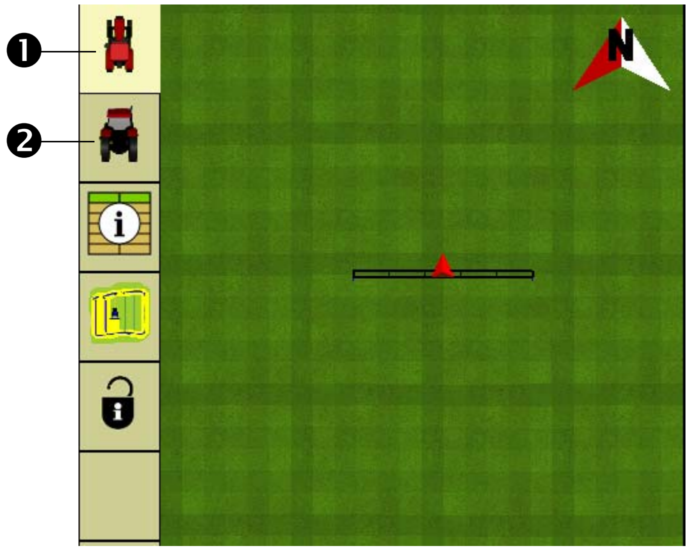
3. From the *Field Selection* screen, tap **OK**.

Run screen view modes

The FM-1000 integrated display screen has two views for representing vehicle guidance on the Run screen:

- Overhead view: Shows a bird's-eye view of the field, with the vehicle in it.

- Trailing view: Shows a three-dimensional representation of the field from the driver's perspective:



Item	Description
❶	Main view (in this example, overhead view)
❷	Auxiliary view (trailing view)

To change the view mode, tap the icons in the upper-left of the run screen.

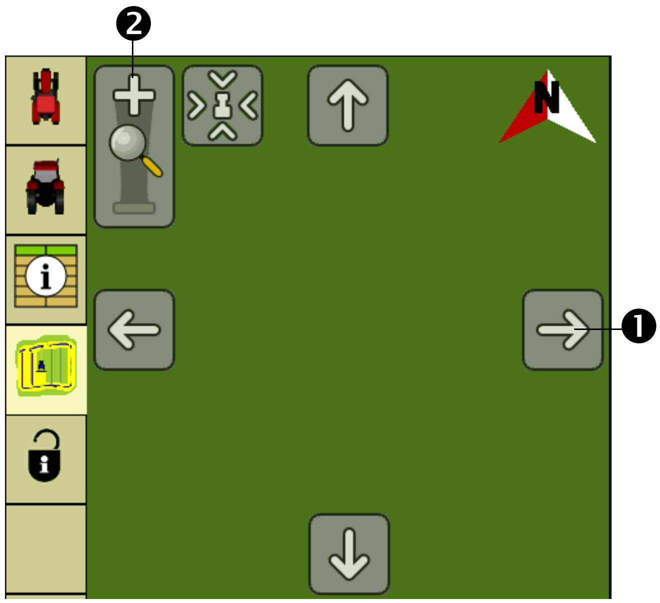
Zoom and Pan functions

The FM-1000 integrated display has five levels of zoom. A close-up view of the vehicle enables you to navigate more accurately, while a long view enables you to see more of the field.

New in version 3.0 of the FM-1000 integrated display is a pan function on the Run screen that gives you the ability to view the field outside of the normal viewing area.

Accessing the zoom and pan functions

1. To access the zoom and pan functions from the Run screen, press .



2. To pan around the field, press one of the four arrow icons ❶ positioned at the edge field area.
3. To zoom in and out, tap either the plus (+) or minus (-) symbol linked to the magnifying glass ❷.

***Note** – Tapping the field area of the Run screen when in zoom and pan mode turns the magnifying glass zoom feature on and off.*

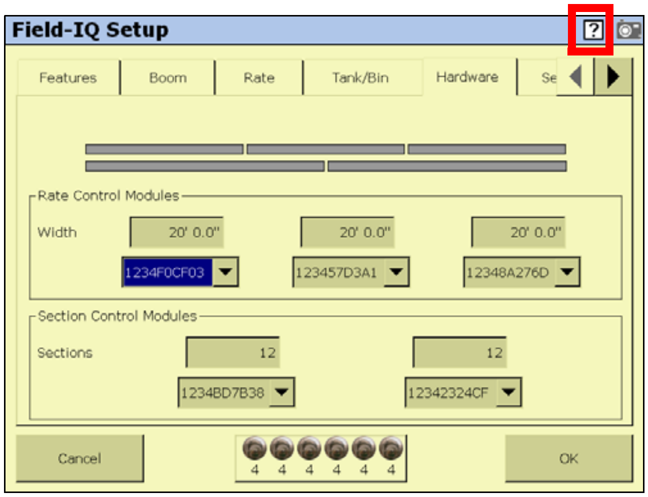
The fifth level of zoom in the pan view is a summary view of all your coverage. It adjusts, depending on the size of the field. It does not include grid lines.

Tip – If you close the field, create a second field and then show the summary view, the summary view may be zoomed to show the area of both fields. To avoid this, restart the display. The view will be correct.

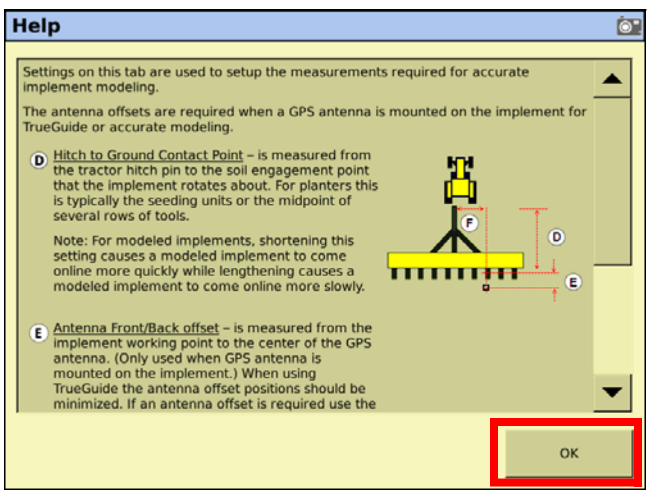
For more information on using the Run screen, see The Run screen layout, page 49.

Context-sensitive help

The FM-1000 integrated display has context-sensitive help screens that provide details and helpful information about the current screen. To access the help, tap ?:



A *Help* screen, similar to the one show below, appears. To exit the *Help* screen and return to the previous screen, tap **OK**:



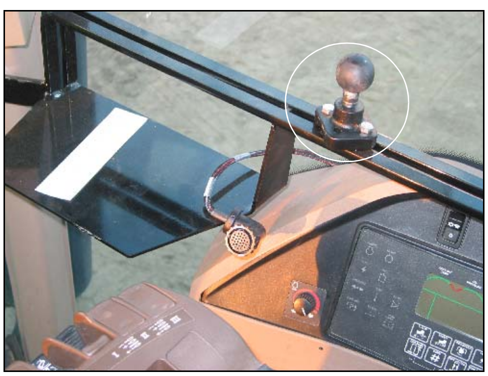
Installing the display

Mount the FM-1000 integrated display in the vehicle cab, in a position that is easily accessible.

1. Use the included M6 x 1" screws to firmly screw the mounting plate to the back of the display.

2. Attach the RAM mount to the ball on the mounting plate.

3. Select a position in the cab for the display. The FM-1000 integrated display is mounted in the cab with a bar style RAM mount.
4. Use the provided bolts to attach the bar mount to the rail.



5. Hold the display in the selected location to ensure that it is comfortably accessible from the driver's seat.
6. Attach the other end of the RAM mount to the ball on the bar mount and then tighten the screw.

Connecting the display

***Note** – The FM-1000 integrated display connects to the Autopilot automated steering system. The Autopilot system requires professional installation in your vehicle. If the Autopilot system is not currently installed in your vehicle, consult your local reseller.*

1. Connect one end of the Autopilot harness to the vehicle.
2. Connect the Autopilot-to-FM-1000 cable to port C of the FM-1000 integrated display.
3. Connect the implement switch. if required.

Inserting a memory stick into the USB socket

The USB socket (❶) is on the rear of the display.

CAUTION – Do not remove the USB memory stick from the socket while the display is writing to or from the device. This will corrupt the data.

CAUTION – If required, only use a USB hub that has an external power option; connecting multiple USB devices to the display without this could damage the USB port.

To insert the USB memory stick:

1. Rotate the display so you that can see the back of it.
2. Insert the USB memory stick into the USB socket.

To remove the USB memory stick:

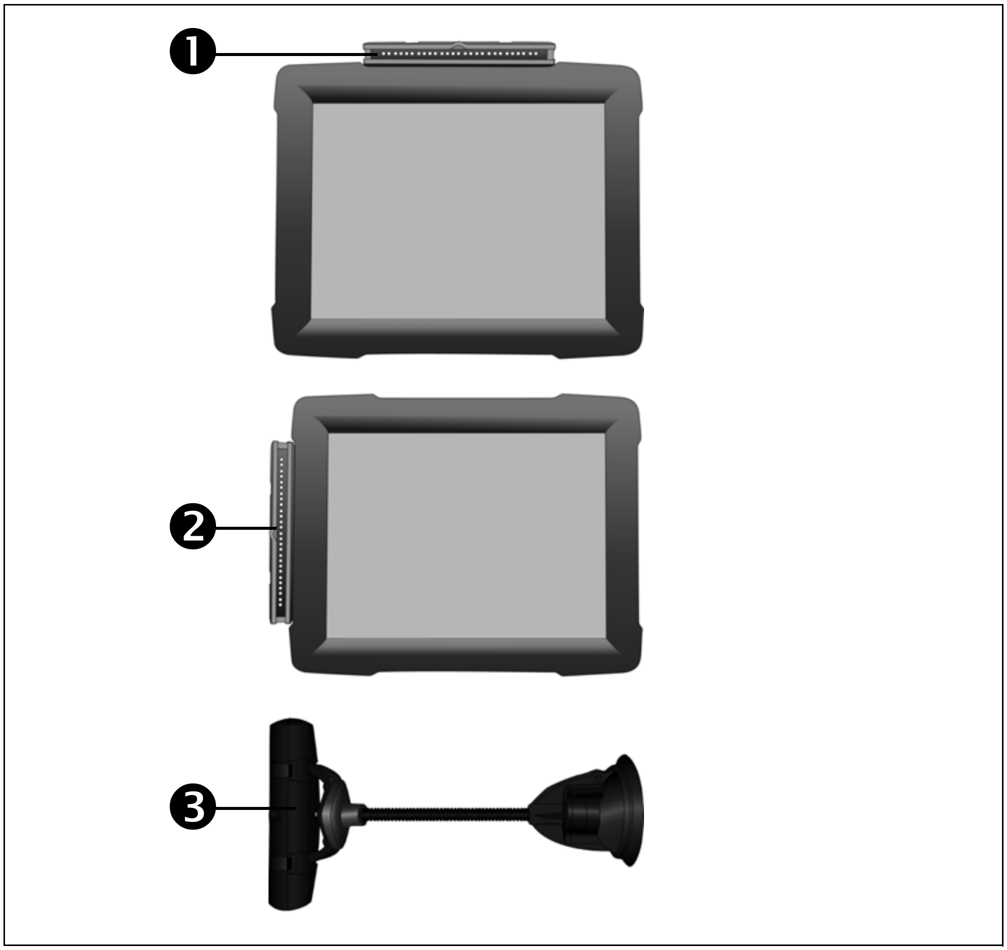
1. Rotate the display so that you can see the back of it.
2. Pull the USB memory stick out of the USB socket.

The display automatically detects when a memory stick is inserted or removed.

External Lightbar/s

The FM-1000 integrated display also supports one or more LB25 external lightbars.

Purchased separately from the display, the LB25 lightbar can be mounted directly on the display, horizontally ❶ or vertically ❷, using the hardware that is supplied with the lightbar, or mounted separately from the display in another part of the vehicle's cab using the supplied suction cup mount ❸:



The lights on the external lightbar replicate the operation of the lights on the display's virtual lightbar.

For more information on installing and configuring the LB25 external lightbar, see Chapter 23, The LB25 External Lightbar.

CHAPTER

3

Getting Started

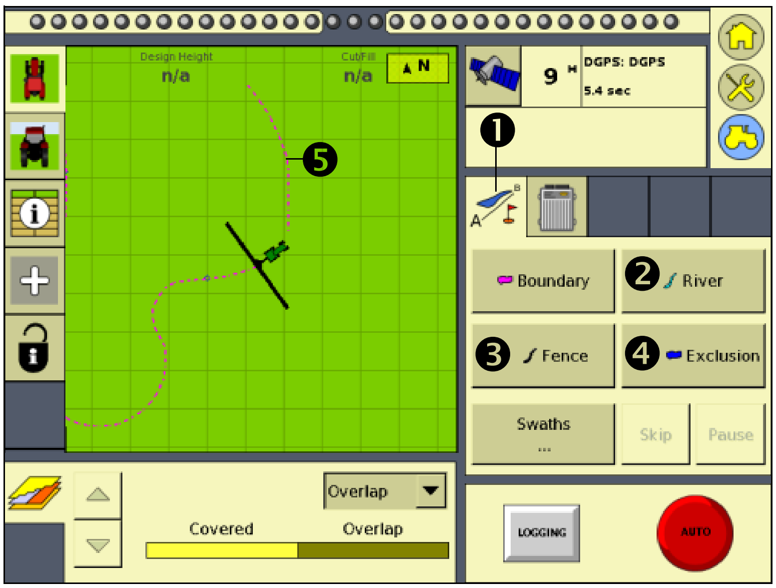
This chapter explains the basic usage and concepts of the FM-1000 integrated display.

Introduction to field features

You can place field features in the field to define points of interest or areas to avoid. There are three types of field feature:

Feature type	What it defines	Example
Point	a single point in a field	Tree
Line	a straight or curved line in a field	Fence
Area	an area of land	Pond

Configure field features that you will want to add to your fields and then assign up to four of them to buttons. These buttons appear on the *Mapping* tab on the Run screen. You can then use the buttons to add field features to your map while driving:



Item	Description
❶	Mapping tab
❷	Feature button set up to represent a river
❸	Feature button set up to represent a fence
❹	Feature button set up to represent an exclusion
❺	Area feature drawn with the Boundary feature button

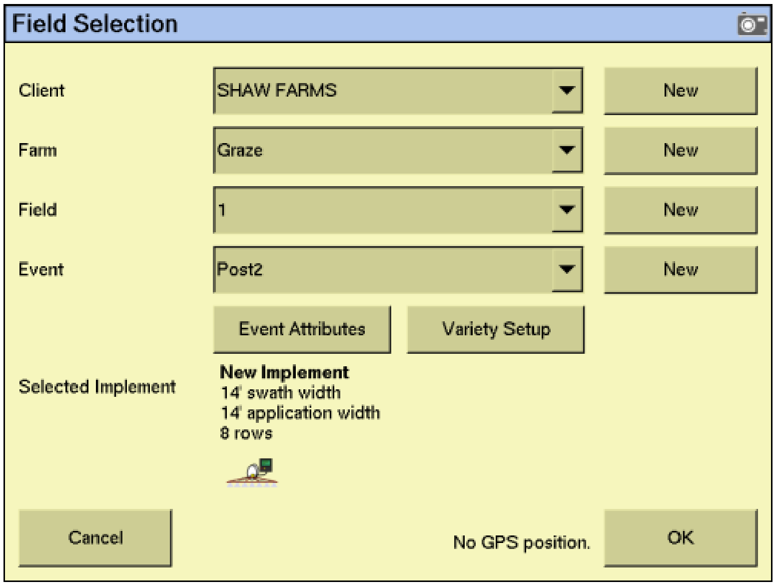
***Note** – For more information on setting up the* **Feature** *buttons, see* *Configuring feature mapping, page 101*

Starting a field

This is the screen where you either re-open an existing field or create a new field. You must select a Client, Farm, Field, and Event, in that order.

Note – *The first time that you use the Field Selection screen, there are no existing fields so you must create one.*

1. Tap :



2. Do one of the following:
   - Create a new client. See Creating a client, page 46.
   - Select an existing client from the *Client* list. The *Farm* list now contains only the farms associated with that client.
3. Select the appropriate farm or create a new one.
4. Select the appropriate field or create a new one.
5. Select the appropriate event or create a new one.
6. To add more information for record keeping, tap **Event Attributes**. The *Event Attributes* screen appears. See Adding record-keeping information, page 47.
7. To add and edit information on the variety of products that can be distributed from the implement tap **Variety Setup**. See Logging varieties, page 70
8. Tap **OK** to enter the Run screen.

Once you create the field, select a swath pattern to use while you drive the field. See Selecting a swath pattern, page 56.

Creating a client

1. Tap **New** beside the *Client* list. The *Client* screen appears.
2. Tap the appropriate buttons to enter the name:

Select...	To...
CAPS	enter capital letters or symbols
<<	delete the previous character
CLEAR	delete all characters and start again

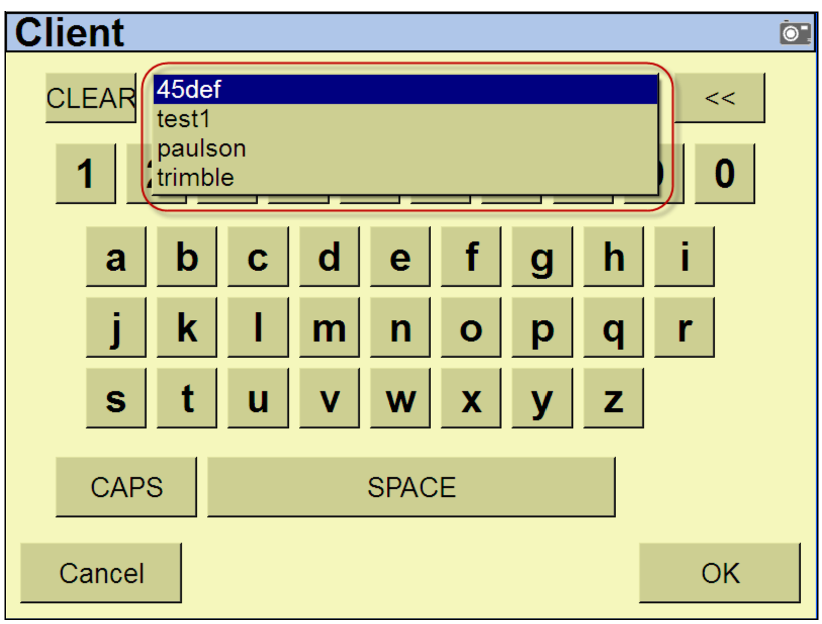
3. Once the name is entered, tap **OK**.
4. Repeat this process to create a farm, field, and event (and record-keeping Event Attributes, if required).
5. If necessary, change the implement.
6. Tap **OK**.

Accessing data dictionary entries

If you already created *Field Selection* entries with the data dictionary editor, you can access them as you open the field:

1. From the *Field Selection* screen, tap **New** for any of the field selection attributes. The keyboard input screen appears.

   If there are predefined data dictionary entries for the current attribute, a drop-down arrow appears next to the text entry field.
2. Tap the drop-down arrow and then select the required data dictionary entry:



3. Tap **OK**.

Additional settings

Limit Field Selection Filter

When opening existing fields, the FM-1000 integrated display can limit the number of fields displayed based on a pre-defined distance from the current GPS position. For more information on configuring the filter, see Enabling the Limit Field Selection filter, page 112.

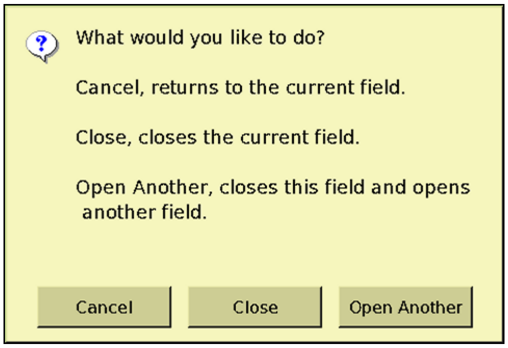
Adding record-keeping information

To add the following categories, tap **Event Attributes**:

Item	Description
Operator name	The name of the vehicle operator
Operator EPA#	The vehicle operator's EPA license number for spreading restricted-use or state-restricted pesticides or herbicides
Harvest Year	The year that the crop is going to be harvested
Farm Location	The country or region where the farm is located
Vehicle	The vehicle used in the operation
Implement	The implement connected to the vehicle
Application Method	The application method used (for example, spraying, seeding, or harvesting)
Wind speed	The average wind speed
Wind gust speed	The maximum speed of any wind gusts
Wind direction	The average wind direction
Sky conditions	The amount of cloud cover
Soil conditions	A description of the state of the soil
Soil type	A description of the soil type in the field
Temperature	The current temperature
Relative humidity	The humidity percentage
Crop	The crop grown in this field
Target pests	(If spraying) the pest that the spray targets
Custom 1	Additional information of your choosing
Custom 2	Additional information of your choosing
Custom 3	Additional information of your choosing
Custom 4	Additional information of your choosing
Material	The material being applied

Closing a field

Once you finish using a field, tap to close it. The following dialog appears:

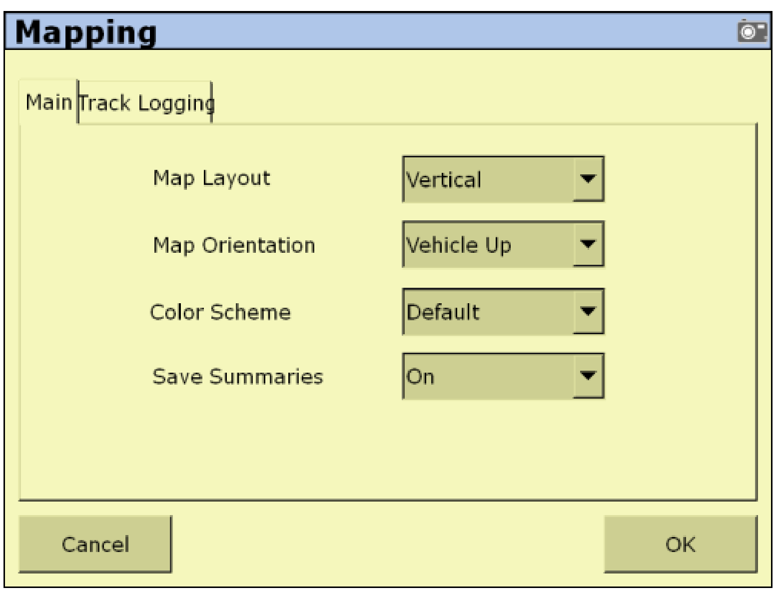


Tap…	To…
Cancel	return to the currently open field.
Close	close the current field and return to the Home screen.
Open another	close the current field, and open a new field.

Saving an event summary

When a field is closed, the system saves an HTML summary for the event. To reduce the time it takes to close a field, saving the summary file can be disabled. To turn Save Summaries off, do the following:

1. In the *Configuration* screen, select System and then tap **Setup**.
2. In the *Display Setup* screen, select Map Settings and then tap **Setup**.
3. In the *Mapping* screen, select On or Off from the *Save Summaries* list:

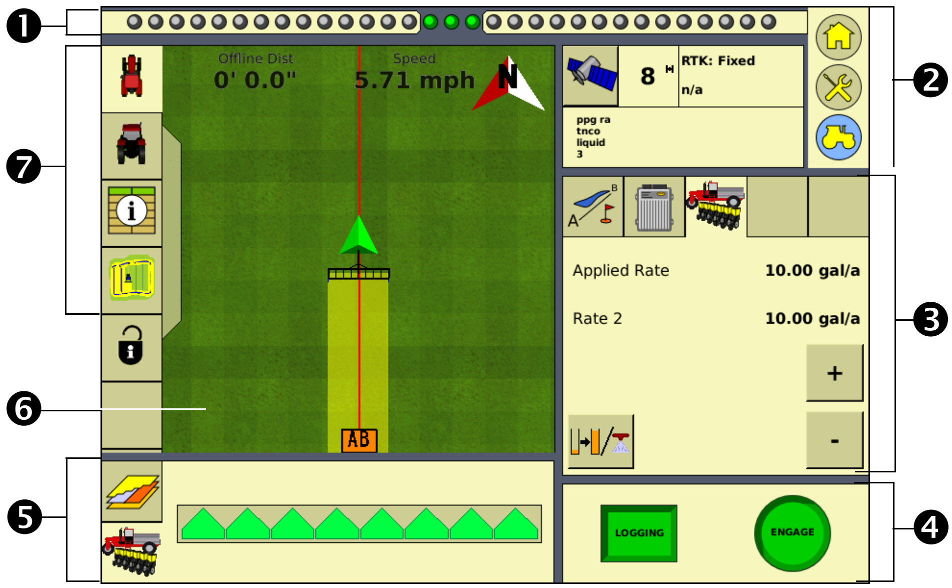


For more information, see Saving a PDF version of the current field, page 609.

The Run screen layout

The Run screen is where you receive guidance and drive the vehicle.

The appearance of the screen changes, depending on which plugins you have installed.

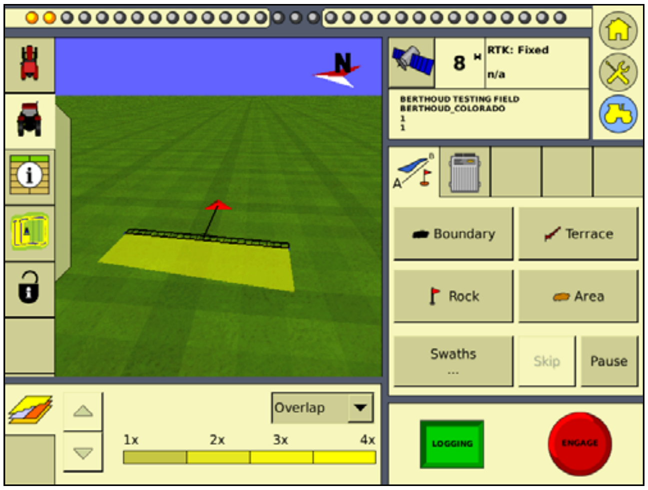


Item	Description
❶	Virtual lightbar
❷	GPS receiver(s) information and Client/farm/field event information
❸	Plugin tabs
❹	Logging and engage buttons
❺	Plugin information tabs
❻	Run screen
❼	View mode / Zoom and Pan function buttons

These items are described in more detail below.

Hashed grids

Hashed grids provide an immediate measure of distance. Each small square represents 10 feet, and each dark green outline represents 50 feet:



Virtual lightbar

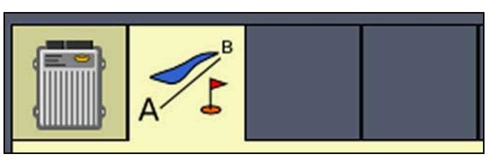
The virtual lightbar provides vehicle guidance. When the vehicle is perfectly on the guidance line, the three center (green) LEDs are lit:

When the vehicle moves off the guidance line to the left or the right, the three LEDs that are lit drift to the side:

To configure the virtual lightbar, see Configuring the lightbar settings, page 110.

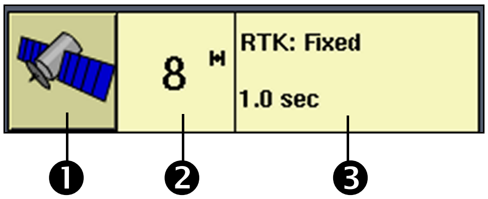
Plugin tabs

Most of the plugins have features that appear on a tab on the Run screen. To select a tab, tap the top of it:



GPS receiver information

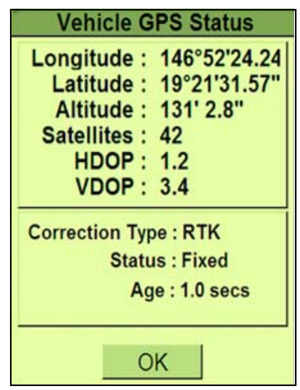
The button in the top right of the Run screen provides information about GPS:



Item	Description
❶	Satellite Information button
❷	Current number of satellites
❸	Type and age of correction

If the GPS signal is lost completely, the No GPS message appears.

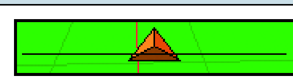
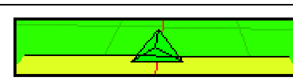
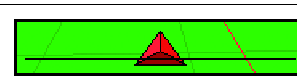
Tap the satellite information button to view the information on it.



There can be more than one row, depending on the plugin that is installed. If the plugin requires a second GPS receiver (for example, the second GPS receiver mounted on the implement for the TrueTracker™ system), then the upper information row relates to the vehicle GPS receiver and the lower information row relates to the second GPS receiver.

Engage button

When you create a guidance line, you can use the **Engage** button to engage or disengage the Autopilot automated steering system. The button has three states:

Engage status	Button color	Vehicle icon color
Ready to engage		
Engaged		
Cannot engaged		

To engage the vehicle, tap **Engage**. The system engages and the button turns green.

To disengage the vehicle, do one of the following:

- Turn the steering wheel to trigger the manual override.

- Tap **Engage**.

The system disengages and the **Engage** button turns gray.

If the button is red, tap it to find out why.

Logging button

The **Logging** button engages and disengages coverage logging:

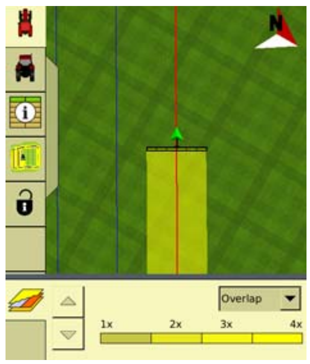
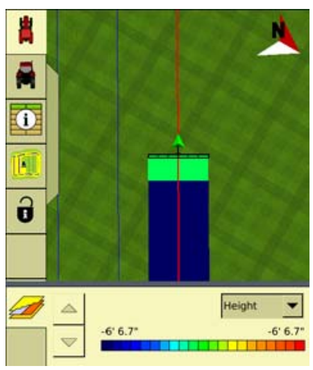
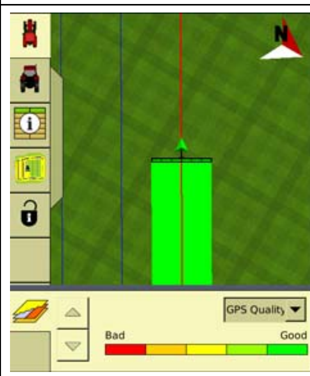
Logging button color	Meaning
Gray 	Coverage logging is not engaged
Green 	Coverage logging is engaged

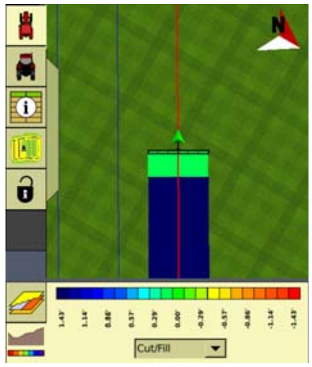
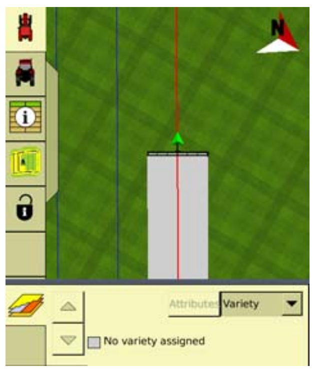
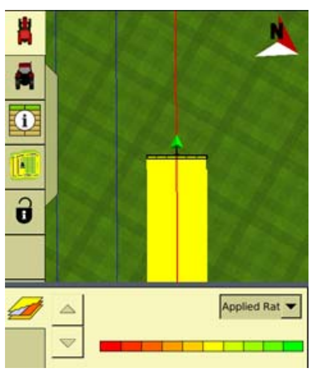
Plugin information tabs

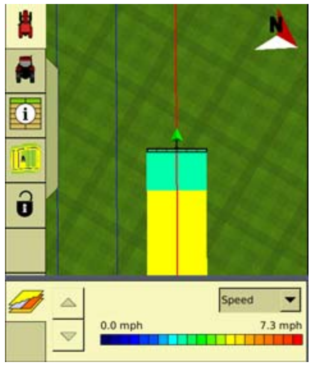
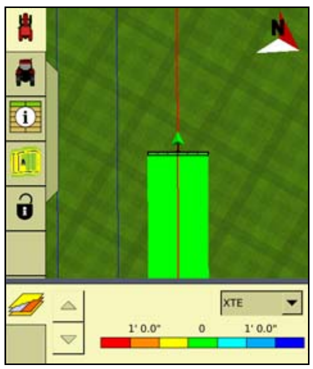
As with the plugin tabs, the plugin information tabs that appear differ depending on which plugins are installed:

Mapping information tab

The Mapping information tab enables you to view your coverage from a number of perspectives:

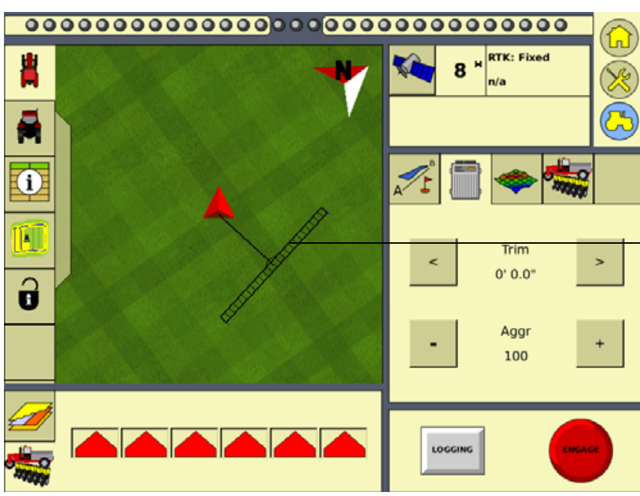
Setting	Example	Coverage shows
Overlap		General coverage and overlap
Height		Altitude of GPS receiver
GPS Quality		GPS signal quality

Setting	Example	Coverage shows
Cut/Fill (FieldLevel)		Cut and/or fill
Variety		Different varieties. See Logging varieties, page 70.
Applied Rate		Shows variations in application rate.

Setting	Example	Coverage shows
Speed		Variations in the speed of the vehicle, as different colors on the Run screen.
Average Cross Track Error (XTE)		The position of the implement.

Guidance window

The guidance window shows your vehicle, coverage, field features, and guidance lines, and for coverage mapping, sections appear on the implement:



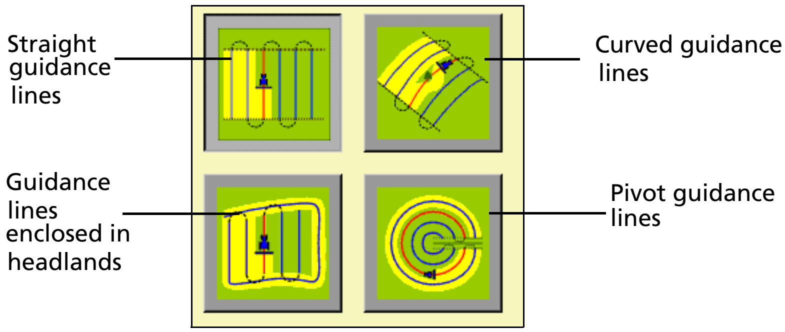
For a description of how you can view the guidance window, see Run screen view modes, page 35.

Selecting a swath pattern

To obtain guidance with the FM-1000 integrated display, you can use:

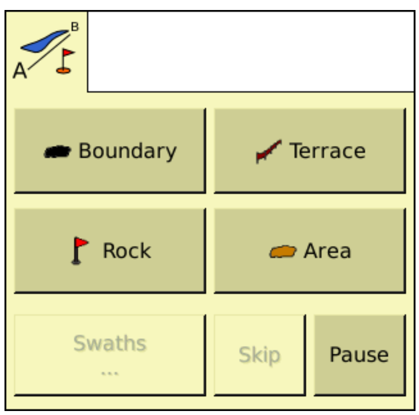
- One of the four standard swath pattern types
- The FreeForm guidance pattern. See Creating guidance with the FreeForm pattern, page 61.

Use the standard patterns to create different shaped guidance lines on the display.

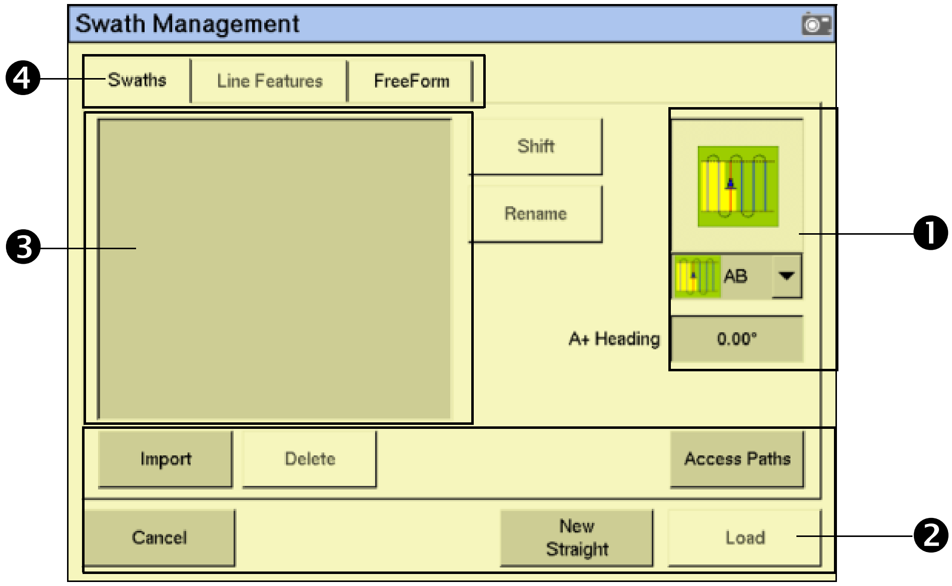


To select a swath pattern:

1. On the Run screen, select the *Mapping* tab:



2. Tap **Swaths**:



Item	Description
❶	Guidance patterns
❷	Line management buttons
❸	Existing guidance lines
❹	Guidance type buttons

3. Select the appropriate pattern from the drop-down list on the right of the screen.

Creating a new line

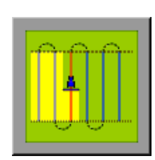
The type of line that you can create depends on the swath pattern that you selected.

Creating a straight line

There are two ways to create a straight line:

- ***AB Line*** – Define the start and end points.
- ***A+ Line*** – Define a point on the line and the heading direction.

To create a straight AB Line:



1. From the *Swath Management* screen, select the straight line field pattern.
2. Enter an access path, if required. See Adding an access path, page 64.
3. Tap **New Straight**. The Run screen appears.

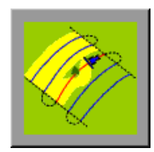
4. To create the start point of the line, tap **Set A**.
5. Drive to the end of the line. The end (B) point must be at least 50 meters (160 feet) from the A point.
6. Tap **Set B**. The new AB Line appears on-screen.

   To extend the line, drive further along it and then tap **Set B** again.
7. Tap **Done**.

To create a straight A+ line by selecting one point and the angle:

1. From the *Swath Management* screen, select the AB Line field pattern.
2. Enter an access path, if required. See Adding an access path, page 64.
3. In the A+ Heading window, enter the angle that you want the line to be on or select a previous AB Line to use its heading. The default angle is the same as the previous AB Line heading.
4. Tap **New Straight**. The Run screen appears.
5. Drive to the start of the line and then tap **Set A**.
6. Tap **Use A+**. The new A+ line appears.
7. Tap **Done**.

Creating a curved line



1. From the *Swath Management* screen, select the Curve field pattern from the drop-down list.
2. Enter an access path, if required. See Adding an access path, page 64.
3. Tap **New Curve**. The Run screen appears.
4. Drive to the start point of the curve and then tap **Set A**.

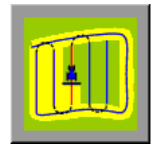
   To stop recording your exact path and create a straight section of line, tap the **Record** button. See page 60.
5. Drive the curve until you reach the end point and then tap **Set B**.

   The new curve appears.

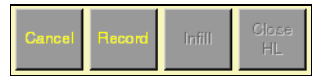
Creating a headland

A Headland is a straight AB Line or an A+ line pattern that is confined inside a boundary. This boundary is called the headland.

Note – *If you want to create a headland based on the A+ line pattern, select the straight line pattern and then set the A+ heading for the internal line. Then complete the following steps.*



1. From the *Swath Management* screen, select the Headlands field pattern from the drop-down list.
2. In the *# Headlands* window, enter the width of the headland boundary in swaths. For example, if you enter **2**, the headland will be 2 swaths wide.
3. Tap **New Headland**. The Run screen appears with the headland definition buttons on the Mapping tab.

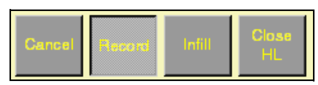


4. Drive to the start point of the headland and then tap **Record**. A red line appears behind the vehicle to show that the headland is being recorded.

***Note** – You must define the inner pattern **before** you complete the headland.*

5. To define the inner pattern, tap **Infill**. The Mapping tab changes to show the inner pattern buttons.

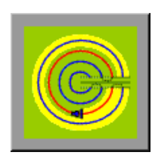
6. When you reach where you want the A point, tap **Set A**.
7. Do one of the following:
   – To create an internal AB Line, drive to where you want the B point (at least 50 m (164 ft)) and then tap **Set B**.
   – To create an internal A+ line, tap **Use A+**.
8. Tap **Back to HL**. The buttons on the Mapping tab change back to their original appearance.



   When you complete the headland circuit, the system will draw a straight line from the vehicle back to the start point, so drive the vehicle to a position on the headland circuit where a straight line back to the start will not cut off part of the pattern.
9. Tap **Close HL**.

   The new headland appears.

Creating a pivot



1. From the *Swath Management* screen, select the Pivot field pattern from the drop-down list.
2. Tap **New Pivot**.

   The Run screen appears.
3. Drive to a point on the outermost rut of the pivot and then tap **Set A**.
4. Follow the pivot rut around to the end and then tap **Set B**. The *Enter Distance to Pivot Field Edge* screen appears.

5. Enter the distance or the number of rows from the current path to the outside of the pivot and then tap **OK**.

   The pivot appears.

Adjusting the outer edge radius

The pivot has an outer edge radius that is used to calculate coverage area. Once you create a pivot, you can adjust the outer edge radius:

1. From the Run screen, tap **Swaths**. The *Swath Management* screen appears.
2. Select the pivot to be adjusted from the list of available pivots.

***Note** – The default is the AB curve.*

3. In the *Outer Edge Radius* window, adjust or enter the value that represents the distance from the pivot center to the outer edge and tap **OK**.

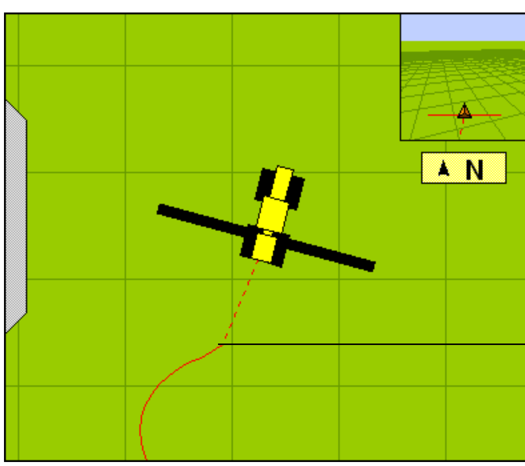
   The *Swath Management* screen appears.

4. To update the pivot, tap **Load**. The Run screen appears with the new pivot dimensions.

The Record button

When you create guidance based on the curve or headland pattern, the **Record** button is available. The **Record** button enables you to insert a straight section of line, rather than having the line follow the exact path of the vehicle (as happens with direct mapping).

When you select (tap) **Record**, the line you are driving is mapped. When you deselect **Record**, the display stops directly mapping your path. Instead, a dotted line spans from the vehicle to the point where you deselected **Record**. When you select the button again, the line becomes solid and your path is mapped again:



Point where **Record** was de-selected

Creating guidance with the FreeForm pattern

The FreeForm pattern is an advanced pattern that enables you to create multiple lines of different types in a single field to obtain guidance in fields of any shape. You need to record each line that you drive, to generate the next guidance line. You can create:

- Curved line segments
- Straight line segments in the form of straight AB Lines

With this combination, you can use the FreeForm pattern to create non-circular spirals or multiple curved guidance lines for irregular-shaped fields.

Tip – With FreeForm curves, remember that your next guidance line will appear only if you record your vehicle's path along the current guidance line. Record each pass to generate your next guidance line.

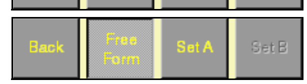
Creating a FreeForm section

1. From the Run screen, tap **Swaths**. The *Swaths Management* screen appears.
2. Select the *FreeForm* tab (in the upper left of the screen). The **New FreeForm** button becomes available (toward the lower right of the screen).
3. If necessary, select the **Record FreeForm when logging** button. See Recording FreeForm guidance simultaneously with coverage, page 63.
4. Tap **New FreeForm**. The Run screen reappears with the **Define FF**, **Next Path**, and **Pause** buttons on the *Mapping* tab.

Creating a curved FreeForm section

1. Tap **Define FF**. The FreeForm buttons change.

2. Tap **FreeForm** to begin drawing a FreeForm line. The line follows the path of the vehicle.



3. To complete the FreeForm pattern, do one of the following:
   - De-select the **FreeForm** button.
   - Perform a U-turn.

***Note** – If you are driving an inward spiral, leave the **FreeForm** button selected. The segments will continue to be defined.*

Creating a straight FreeForm section

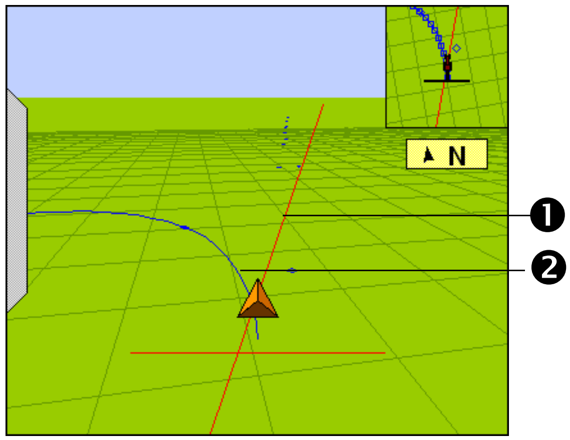
1. Tap **Define FF**. The FreeForm buttons change.

2. Drive to the start point of the line and then tap **Set A**.

3. Drive to the other end of the line and then tap **Set B**. The guidance line appears.

Switching between FreeForm sections

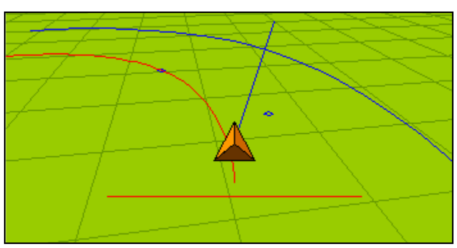
You can switch ("snap") between the different FreeForm sections. In the following example, there are 2 FreeForm sections:



Item	Description
❶	A straight FreeForm AB Line (selected)
❷	A curved FreeForm section

You may want guidance along either line.

To snap between one section and another, tap the **Next Path** button on the Run screen (If the **Next Path** button is not available, tap **Back** and then tap **Next Path**). Guidance jumps to the next section:

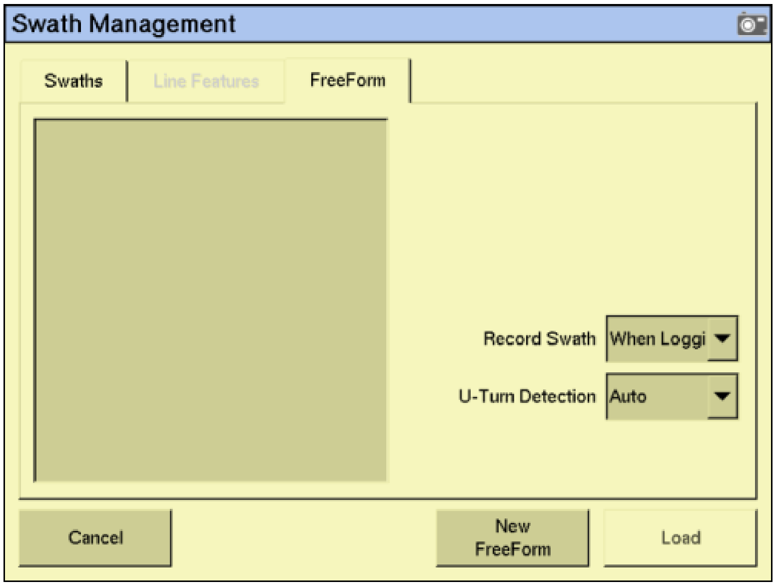


To cycle through the available sections, keep tapping **Next Path**.

***Note** – This selects a curve only if the curve is within the snapping zone.*

Recording FreeForm guidance simultaneously with coverage

When you select the FreeForm pattern on the *Swaths Management* screen, you can select the *When Logging* option from the *Record Swath* drop-down list:



When this option is selected, the system activates FreeForm logging whenever coverage is being logged.

You can simultaneously turn on or off coverage and FreeForm logging with the **Logging** button on the Run screen. Or, if you have an external remote logging switch that controls coverage logging, the system records FreeForm curves when the remote logging switch is enabled (the remote switch turns on coverage, which begins FreeForm logging).

However, if a Field-IQ, EZ-Boom, or Tru Application Control system is connected, the master switch (on the Field-IQ or EZ-Boom controller or on the Tru Application Control harness) now controls FreeForm logging and not coverage itself.

***Note** – Coverage switching will not create large numbers of short FreeForm sections.*

Loading a line

To load a line that you previously created in this field:

1. From the Run screen, tap the **Swaths** button. The *Swath Management* screen appears.
2. Do one of the following:
   - To load a straight section, select the appropriate section from the list on the left of the screen.
   - To load a FreeForm curve, select a curve from the list on the left of the screen. The system loads the closest line to you.

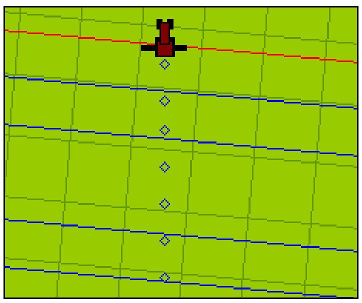
3. Tap **Load**. The Run screen appears, with the line loaded.

If you try to load a line that is over 100 km (63 miles) away, the following message appears:

Your current position is too far from the field to work in it.

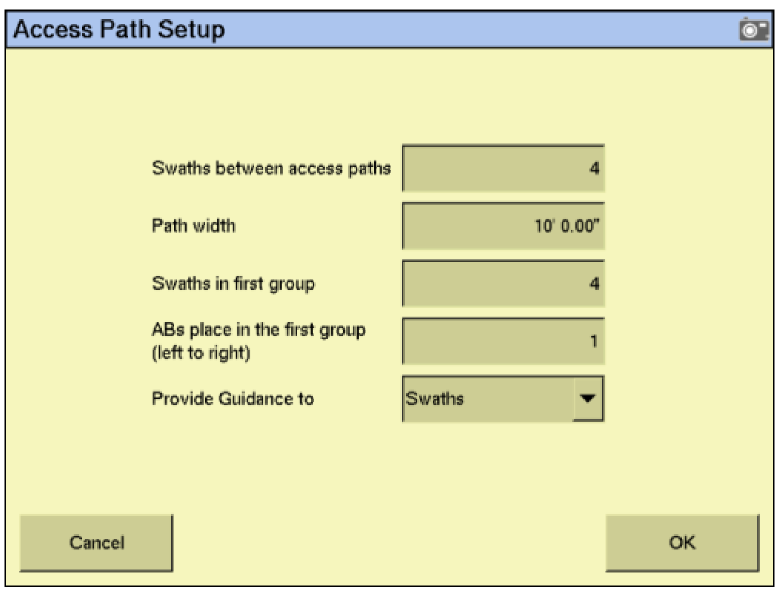
Adding an access path

An access path is a space between your guidance lines. They can be useful if there is road (or other field feature that breaks the consistent flow of swaths) through the middle of your field. You can add access paths on a straight or curved pattern, but not headlands or pivots:



Specify the location and width of the access path when you create the line:

1. From the *Swath Management* screen, tap **Access Paths**:



2. Enter a value in the *Swaths between access paths* field. This value must be equal to or higher than the *Swaths in first group* setting. The next access path will appear this number of swaths beyond the first access path, and will continue to repeat after this number of swaths.

***Note** – You must fill in both of these fields.*

3. Enter a value in the *Path width* field. This is the width of the access paths.
4. Enter a value in the *Swaths between access paths* field. The access path will appear after this number of swaths (including the master line).
5. Enter a value in the *ABs place in the first group (left to right)* field. This setting enables you to specify where the master line appears in the first group (from left to right).
6. Select whether the guidance will be based on swaths or access paths from the *Provide Guidance* to drop-down list and then tap **OK**.

Swath management

Several options are available on the *Swath Management* screen. You can delete swaths, rename swaths, or shift them to the left or right.

To access these features, select the *Swaths* tab. You cannot delete, rename, or shift line features or FreeForm curves.

Deleting a swath

To be able to delete swaths, you must have entered the Administration password.

1. From the Run screen, tap the Swath button. The *Swath Management* screen appears.
2. From the list on the left, select the swath to delete.
3. Tap **Delete**. If prompted, enter the password.

   The swath is marked as deleted. The next time that you close the field, the swath is removed from the list.

Note – *You cannot delete a swath that is currently active.*

Renaming a swath

To be able to rename swaths, you must have entered the Administration password.

1. From the Run screen, tap the Swath button. The *Swath Management* screen appears.
2. From the list on the left, select the swath to rename.
3. Tap **Rename**. If prompted, enter the password. The *Enter new swath name* screen appears.
4. Enter the new name for the swath and then tap **OK**.

   The swath is renamed.

Shifting a swath

1. From the *Swath Management* screen, select the swath to shift from the list on the left.
2. Tap **Shift**. The *Enter the Shift Distance* screen appears.
3. Select the correct units for the shift (metric, feet and inches, or rows).
4. Enter the distance to move the swath.
5. Select the direction for the shift. The shift occurs based on the direction of the vehicle, not on the A to B orientation of the line. For example, if you select "Left", the line shifts left of the operator's perspective.

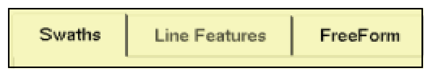
***Note** – If you shift a line, it will shift the original version of the line and remove any skip that you have applied.*

6. Tap **OK**. The *Swath Management* screen appears.

   The new shifted swath appears in the swath list on the left of the screen.

Using the "Guide to" tabs

The Guide to tabs allow automated steering along a swath, line feature, or FreeForm curve.



To use the Guide to tabs:

1. Tap the **Swaths** button. The *Swath Management* screen appears.
2. From the Guide to tabs, select one of the following:
   – *Swaths* for guidance along a swath.
   – *Line Features* for guidance along a line feature.
   – *FreeForm* for FreeForm curves.
3. If you selected:
   – *Swaths*, select the appropriate swath from the list on the left and then tap **Load**.
   – *Line Features*, guidance automatically occurs on the nearest feature. Tap **Load**. The list shows the types and numbers of line features in the current field.
   – *FreeForm*, select the appropriate FreeForm curve and then tap **Load**.

   The Run screen appears. The next time that you engage automated steering, you are guided along the swath, line feature, or FreeForm curve.

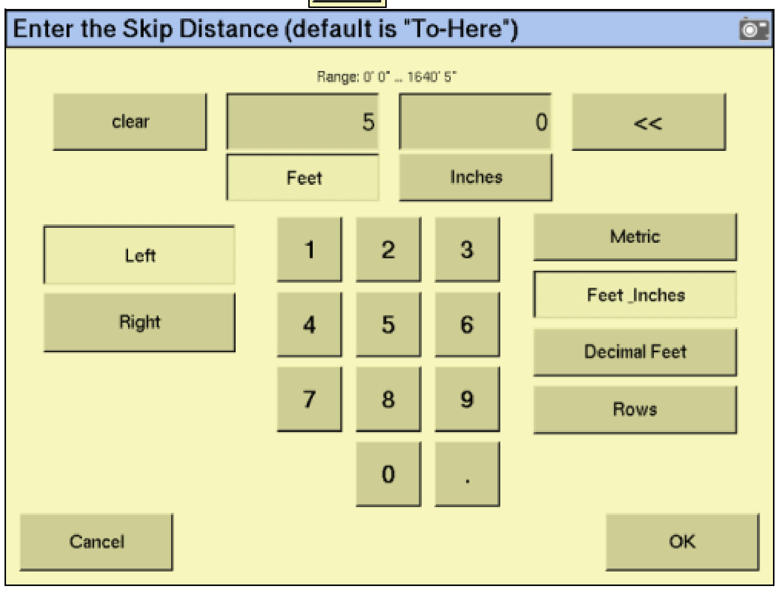
Using Skip to fine-tune navigation

The software uses the original swath that you drove to automatically generate the position of the other swaths. Occasionally, these new on-screen swaths do not perfectly reflect where your swaths are. For example, you may need to skip to the other side of a road.

To correct the spacing of the automatically generated swaths in a field, use the Skip function. After the swaths are generated:

1. From the Run screen, tap 

:



2. Enter the Skip distance and then tap **OK**. The guidance line moves the required amount. The default distance displayed in the edit box reflects your current position. The shift occurs based on the direction of the vehicle, not on the A to B orientation of the line. For example, if you select "Left", the line shifts left of the operator's perspective.

***Note** – The Skip position is temporary; it is not saved to the line permanently. To save a line adjustment, use the Shift feature. See Shifting a swath, page 66.*

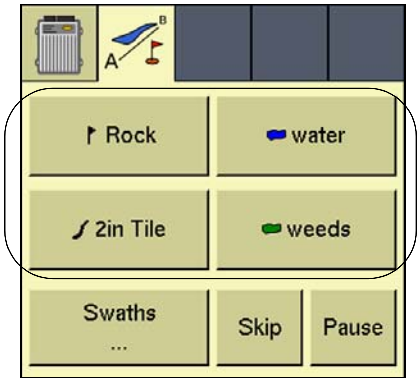
Placing field features on screen

For a description of field features and how to configure the field feature buttons, see Configuring feature mapping, page 101.

For instructions on how to create a separate boundary file that can be used to calculate area and control automatic section switching at the edge of the field, see Activating field boundaries, page 104.

To add a field feature to the map:

1. Select the *Mapping* tab on the Run screen. The features that you defined appear on the tab:



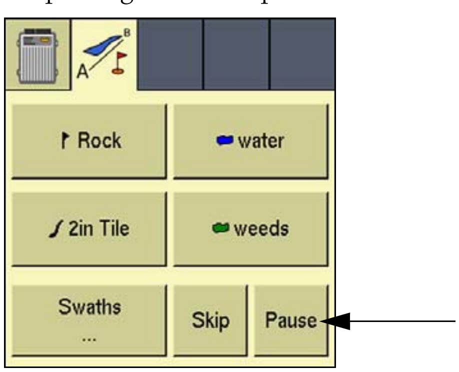
2. Begin to drive the field.
3. When you reach the point where you want to add a feature, tap the appropriate feature button:
   – If the feature is a Point Feature (such as the **Rock** button in the example above), the feature is added.
   – If the feature is a Line Feature (such as the **2in Tile** button in the example above) or an Area Feature (such as the **Water** button), the feature will begin. Area and Line features continue until you tap the button a second time.

Note – *You can add a Point feature* ***while*** *adding a Line or Area feature. For example, use a Line feature to draw an overhead telephone wire and simultaneously use a Point feature to add the telephone poles.*

Pausing guidance

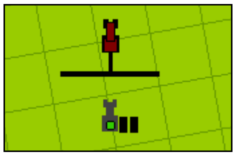
You can pause guidance and return to your position later.

To pause guidance, tap **Pause** in the Run screen:.



When you tap **Pause**, the following occurs:

- A pause icon appears at the point where your vehicle was:.

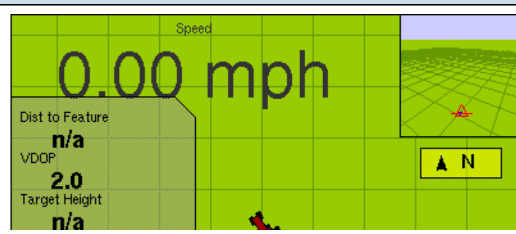
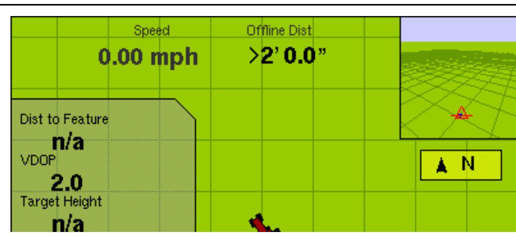


- The status text shows the distance and angle required to return to that point.
- Swath snapping occurs to the pause position; it does not follow your vehicle.
- Your position is saved to a file on the display. You can then close the field and turn off the display. When you next open that field, you will be guided back to your former position.

When you return to your former position, tap **Resume**.

Adjusting the status text size

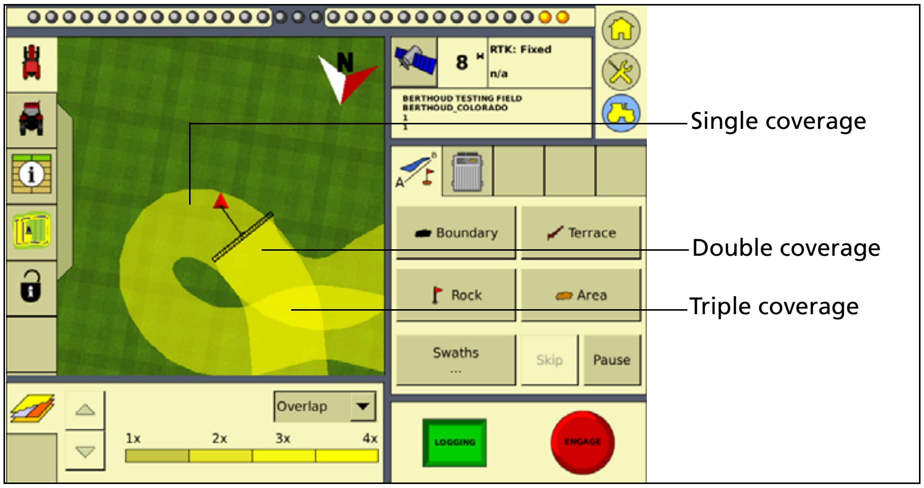
You can control the size of the status text items that are shown at the top of the Run screen. You can show one of the status text items in a large size, or both status text items in a smaller size:

Description	Example
One large status text item	
Two smaller status text items	

To cycle through the status text item display modes, tap the items at the top of the screen.

Introduction to coverage logging

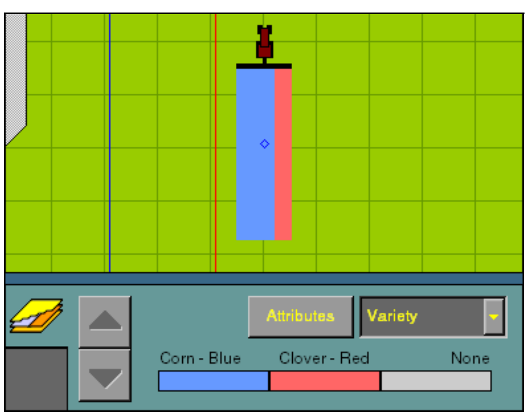
Coverage logging records the area that you have covered when you carry out an operation, for example applying fertilizer to a field. The covered area appears on the Run screen as a translucent yellow area that shows skips as well as single, double, and triple coverage:



To activate coverage logging, tap the **Logging** button on the Run screen so that it changes from gray to green. Tap the button again to stop coverage logging.

Logging varieties

By default, coverage logging appears as a solid yellow block (see above). However, you can set up ***varieties*** that make it easy to see the difference between different types of coverage:



This enables you to:

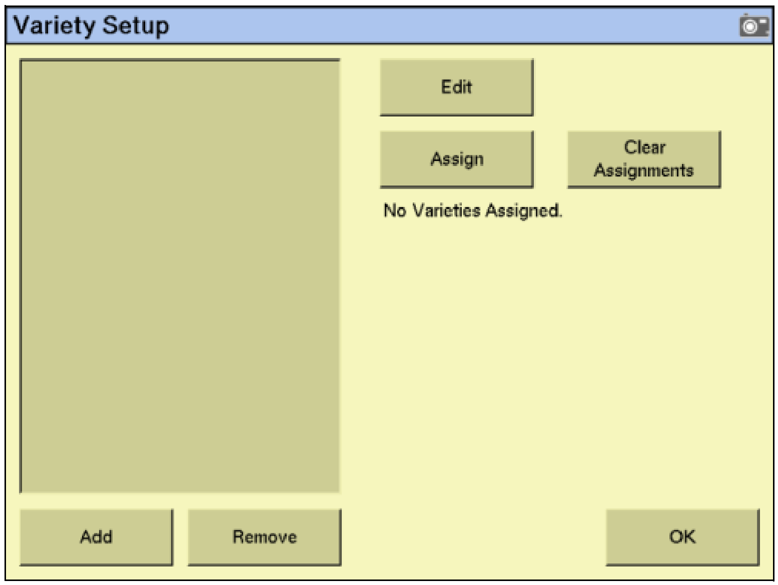
- Change product part way through a field, so that you can later identify which parts of the field are covered in which product.

- Plant or apply two or more different products side-by-side and record the locations in your field. For example, you could put corn seed in the left side hoppers on your planter and clover seed in the right side hoppers and track where each set of seeds is planted.

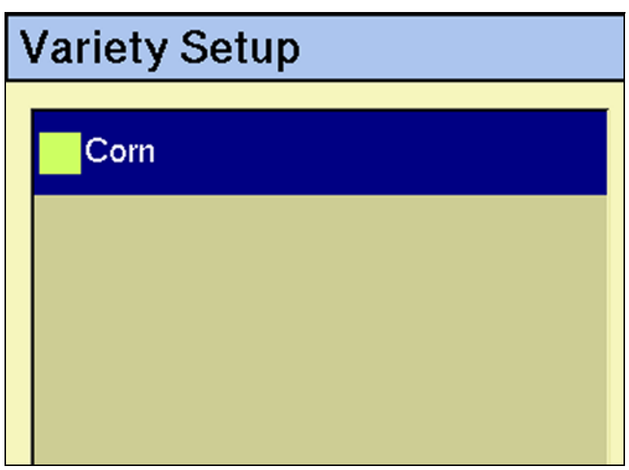
The varieties are assigned to rows on your implement. Specify the number of rows on your implement when you configure it. For more information, see Adjusting the implement settings, page 178.

To configure varieties:

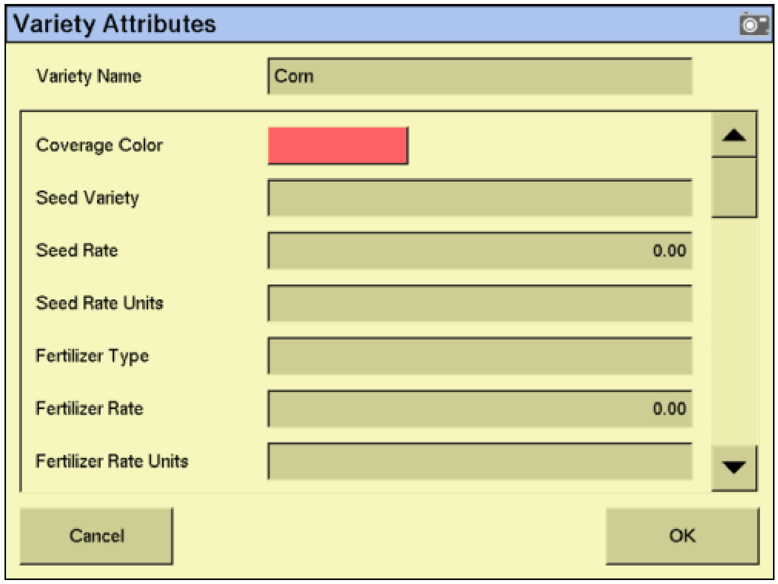
1. From the *Field Selection* screen, tap **Variety Setup**:



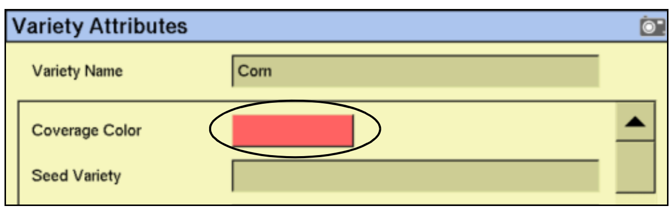
2. To add a new variety, tap **Add**. The virtual keyboard appears.
3. Enter a name for the variety and then tap **OK**. The *Variety Setup* screen reappears with the new variety name in the list:



4. To configure the variety, select it and then tap **Edit**:



5. To change the color that represents this variety on the Run screen, tap the *Coverage Color* color block:



The *Select Color* dialog appears.

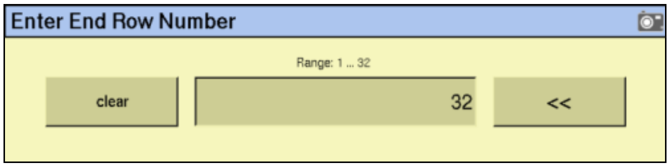
6. Tap the new color.
7. Enter any relevant record-keeping information.
8. Tap **OK**. The *Variety Setup* screen appears.
9. To add additional varieties, repeat Steps 3 through 9.

Now that the varieties are configured, assign them to segments of the coverage.

To assign one variety to the entire implement:

1. Select it from the list and then tap **Assign**. The *Set row range for variety* screen appears.
2. Ensure that the *Start Row* field is set to 1.

3. In the *End Row* field, enter the number that appears at the high end of the range:



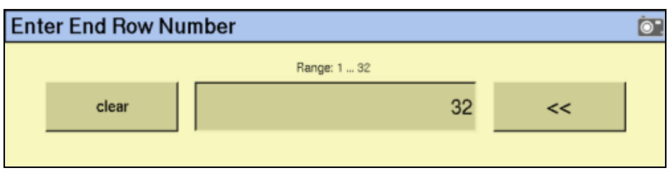
4. Tap **OK**.

The variety is assigned. When you enable coverage logging and set the Mapping information tab drop-down list to Variety, this variety color appears in the guidance window. See page 53.

To assign multiple varieties to the implement at once:

1. On the *Variety Setup* screen, select a variety and then tap **Assign**. The *Set row range for variety* screen appears.
2. Tap the *Start Row* field and then enter the row that variety will start at.

   The default is the first row that is now currently assigned. Row 1 is on the left side of the implement.
3. Tap the *End Row* field and then enter the row that variety will end at:



4. Tap **OK**. The *Variety Setup* screen reappears.
5. Select the next variety and then tap **Assign**.
6. Repeat Steps 2 through 5 for any additional varieties.

Tip – For quick access to the *Variety Setup* screen from the Run screen, set the Mapping information tab drop-down list to Variety and then tap **Attributes**.

If you select a different implement or change the settings of the current implement, the variety assignments are removed.

Prescriptions

You can define variable rate controller setup data, and load prescription files that define the rates to be applied in different areas of the field. This information is used to send target rates to the variable rate controller. Applied rates are received from the controller, and both target and applied rates appear on the screen. In addition, you can log data relating to the variable rate application to the card.

The FM-1000 integrated display can load prescription files created by a Geographic Information System (GIS). The method you use to create the prescription depends on which GIS package you use.

Once you create the prescription, store either the three prescription files in ESRI shape-file format or the single .gdx file in the \AgGPS\Prescriptions\ folder. Then, when you are within the proximity criteria, the prescription is available to load.

When you map a new field or select an existing field, you can also select any shapefile (.shp) or AgInfo GDX (.gdx) prescription file created in AgInfo version 3.5.44.0 or later, that is within the following limits:

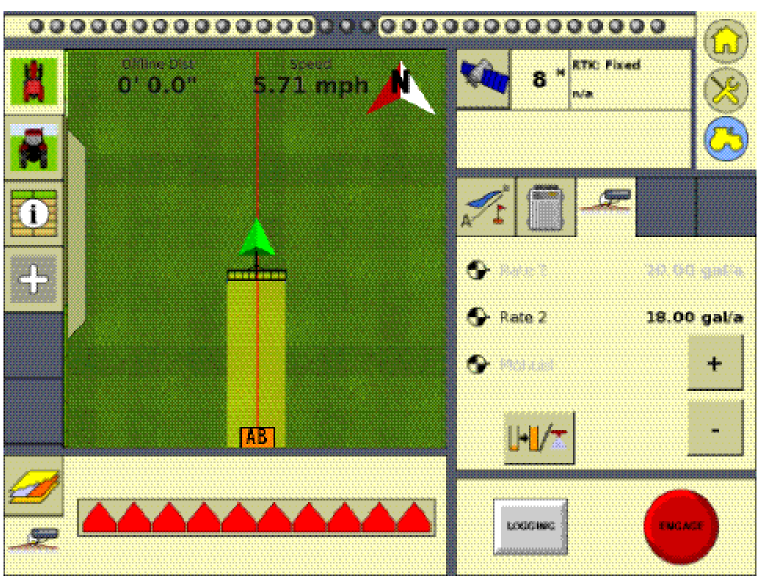
For this type of field...	Prescriptions must...
Boundary	overlap the field boundary
AB Line	overlap the AB Line
Proximity	be within 1 km of the field

If you load a shapefile prescription, select the rate column.

If you use complex contoured prescriptions, loading the prescriptions can take some time. The FM-1000 integrated display shows progress bars while it loads and converts prescriptions.

You can configure the status sliders on the main navigation screen (the Run screen) to show the target rate specified in the prescription file, and the applied rates returned from the controller for the active channel.

When a field is open, a prescription is loaded, and a controller is connected, the target rates (read from the prescription) and applied rates (received from the controller) can be shown in the status text items. An example with as-applied rates displayed is shown below:



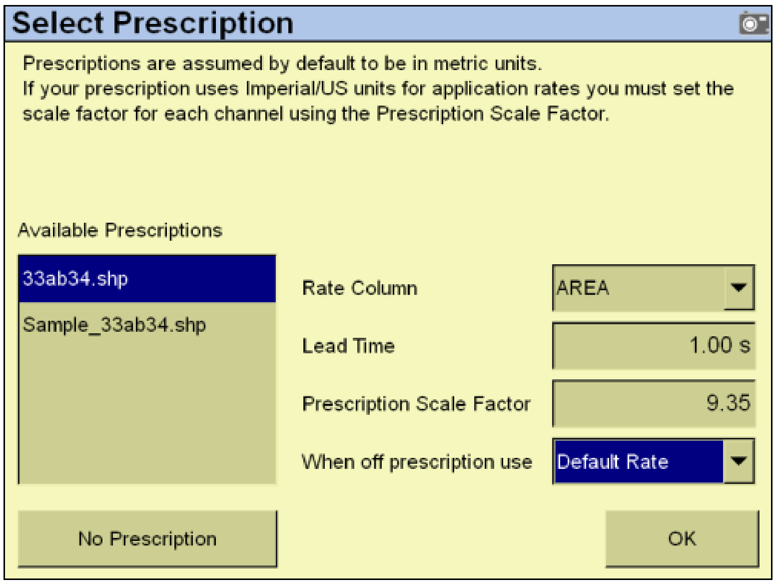
For more information, see Configuring the Status Items, page 88.

To load a prescription file:

1. Map a new field or select an existing field.

   The FM-1000 integrated display searches the card for prescription files within the specified limits. If there are many prescriptions on the card, this can take several seconds, and a progress bar appears.

2. If any prescription files are within the specified limits, the *Select Prescription* screen appears:



3. From the *Available Prescriptions* list, select a prescription file.

***Note** – If an AgInfo GDX prescription has an incorrect format, it does not appear in the Available Prescriptions list.*

4. If you select a shapefile prescription, you must select the correct prescription rate column.

CAUTION – When you select a shapefile prescription, if you choose the wrong column when using a variable rate controller, the applied rate will be incorrect.

   If you select an AgInfo GDX prescription, the *Rate Column* box does not appear.

5. Set the prescription scale factor. Selecting *Prescription Scale Factor* will give a list of scale factors for certain units. Select the scale factor for whatever units are used in the prescription file.

6. Set the lead time. See below.

7. In the *When off prescription use* list, select the target rate for when you are outside the area that is covered by the prescription file. See Last, default, or zero rate, page 76.

8. Tap **OK** to load the prescription file.

A prescription works only when the EZ-Boom Rate switch is in the Rate 1 position. If the switch is in the Rate 1 position, the Increment/Decrement switch is disabled.

If the Rate switch is in the Rate 2 position, the prescription is disabled but the Increment/Decrement switch does work.

Controller lead time

Lead-time is the average time required by the controller before it can react to a requested rate change. This value can be defined in the *Select Prescription* screen. For example, a value of 5.0 means that, on average, it takes the controller around five seconds to change from one rate to a new rate.

The lead time value is used by the FM-1000 integrated display to project the position of the vehicle into the future. The direction and speed of the vehicle are combined with the lead time to project a future position. The target rate at this projected position is sent to the variable rate controller, giving the controller time to reach the required rate at approximately the same time that the vehicle arrives at the projected position.

You must choose an appropriate lead time. This depends on the controller type and configuration, the type of materials being applied, and the nature and specifications of the delivery equipment.

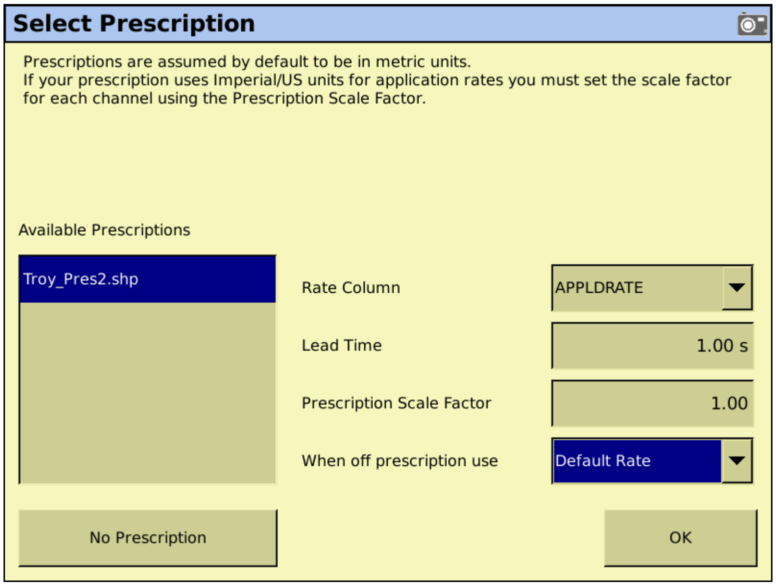
Last, default, or zero rate

When the vehicle moves outside the area covered by the prescription file, no target rate is available. There are three options for controlling the output rate:

- Continue to use the last rate being output when the vehicle moves off the prescription
- Use a default rate
- Use a zero rate

Specify the required option in the *Select Prescription* screen.

- Prescriptions can now be selected even when the vehicle is a great distance away from the field, enabling operators or managers to load a prescription before driving to the field:



CHAPTER

4

Display Setup

In this chapter:

- Accessing the system configuration settings
- Calibrating the touch screen
- Configuring the display

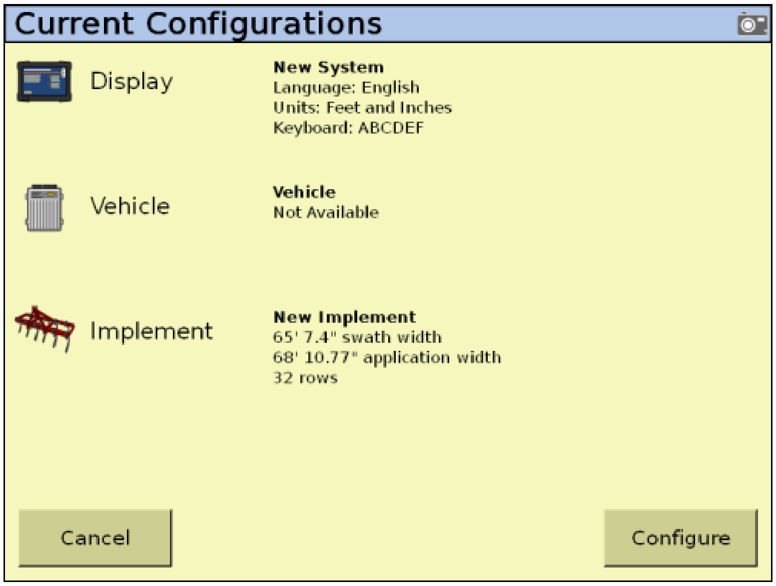
This chapter describes how to configure the basic settings and appearance the display.

Note *– Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the* ***Home*** *button. When prompted to close the field, tap* ***Yes****.*

Accessing the system configuration settings

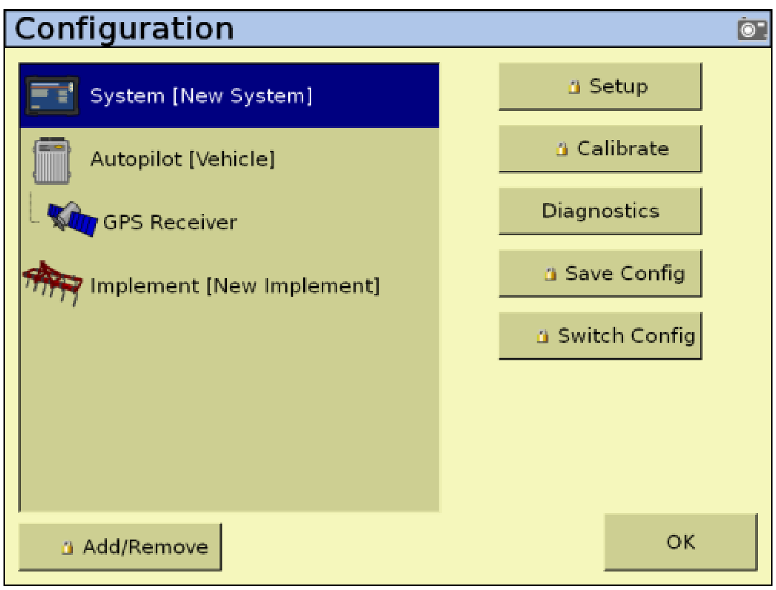
To configure the system settings, do the following:

1. From the Home screen, tap :



2. From the *Current Configurations* screen, tap **Configure**.

   The *Configuration* screen appears, with the currently installed plugins listed on the left of the screen:



Password access

Any **Setup** or **Calibrate** button marked with a padlock icon is protected by two passwords:

Password type	Description
Administration password	Your password. The default is "2009".
Master password	A backup password in case you lose the Administration password. If you require the Master password, contact your local reseller.

The password screen appears the first time that you tap a **Setup** or **Calibrate** button after you turn on the display. Use the virtual keyboard to enter the Administration password and then tap **OK**.

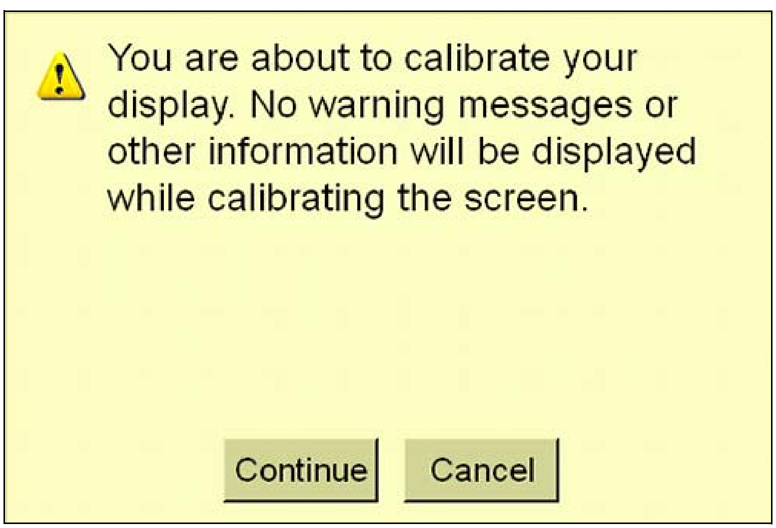
***Note** – Passwords are case sensitive.*

Calibrating the touch screen

The FM-1000 integrated display ships with the touch screen already calibrated. If you need to calibrate the touch screen so that it reads your selections accurately:

1. From the Home screen, tap .
2. From the *Current Configurations* screen, tap **Configure**.
3. Tap the system in the *Plugins* list. The **Setup**, **Calibrate**, and **Diagnostics** buttons become available.
4. Tap **Calibrate**.

   If you have not entered an Administrator password during this session, the *Enter Administration Password* screen appears. See Password access, page 81.
5. Enter your password and then tap **OK**. A warning message appears:



6. Read the message and then tap **Continue**. The *Screen Calibration* screen appears, with a cross-hair in the top left corner:

7. Tap in the center of the cross-hair.

CAUTION – Do not use a sharp item, such as a pencil, to press the screen or you may damage the surface of the screen. Use your finger to press the screen.

The cross-hair appears on another part of the touch screen.

8. Repeat Step 6 eight times.

When the calibration sequence finishes, a dialog appears:

– If your responses were accurate enough, the following message appears:

You have successfully calibrated your touch screen.

– If your responses were not accurate enough, the following message appears:

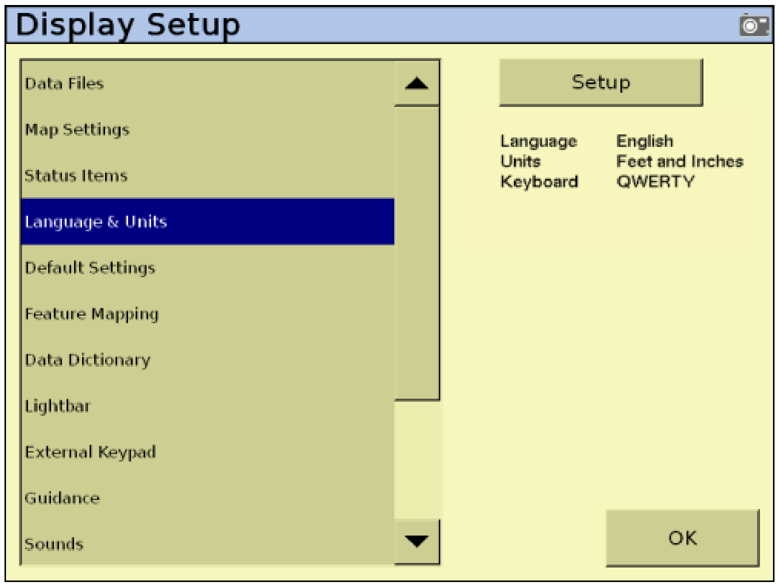
Your screen calibration failed. The difference between actual and calculated points was too large.

9. Tap **OK**. You are returned to the *Configuration* screen.

If the calibration was successful, proceed to Configuring the display. If the calibration failed, tap **Calibrate** again and then repeat Steps 5 through 7 until calibration is successful. If the display calibration continues to fail, consult your local Trimble reseller.

Configuring the display

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. If necessary, enter the Administrator password. See Password access, page 81.



In the *Display Setup* screen, you can configure:

– display preferences
  - map settings (including Night-mode)
  - status item configuration
  - language and units (including keyboard layout) setup
  - default settings

– mapping preferences
  - feature mapping configuration
  - data dictionary editor
  - data files management (this appears at the top of the *Display Setup* list)

– display options
  - external lightbar setup
  - guidance setup
  - sound settings

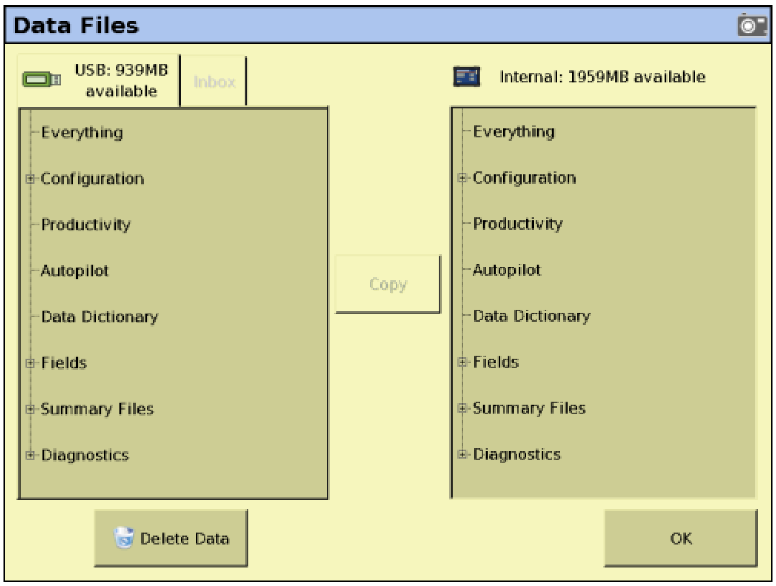
– hardware configuration
  - CAN bus settings

- power management setup
- time zone configuration
- external keypad

These steps are described in more detail in the following sections.

Managing data files

The *Data Files* management screen enables you to manipulate your saved data:



From either the display's internal memory or the USB memory stick, you can copy implements, prescriptions, data dictionaries, field data, or delete unwanted data.

For more information, see Copying or deleting data files, page 630.

Configuring Map Settings (including night-mode)

The *Map Settings* screen has two tabs that enable you to configure various settings for the FM-1000 integrated display.

The Main tab

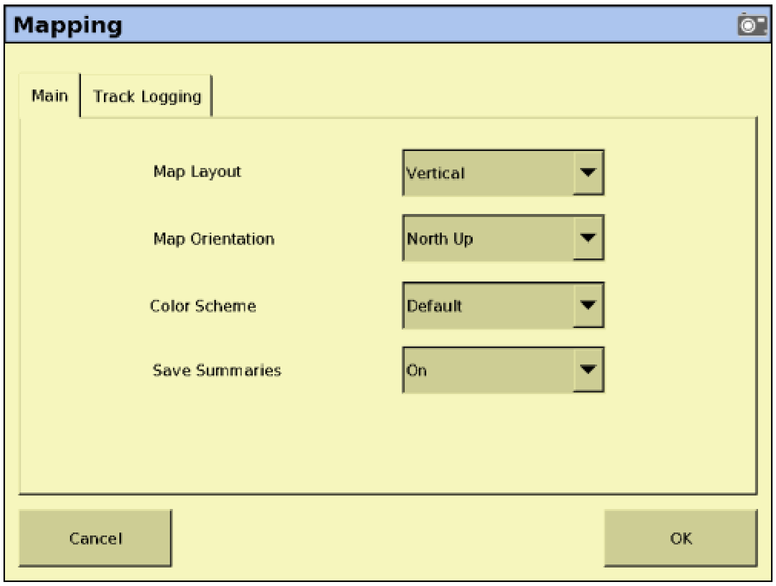
The *Main* tab includes the following options:

Item	Description
Map Layout	Controls how the information buttons toolbar is displayed on the Run screen; the toolbar can be orientated either horizontally or vertically.

Item	Description
Map orientation	Controls the direction that the screen follows the position of the vehicle.
Color scheme	Selects either the default or night-mode color scheme. The night-mode color theme uses darker color themes to make the screen easier to see in low light conditions.

To configure the settings in the *Main* tab, do the following:

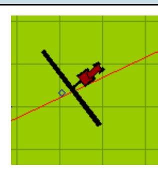
1. In the *Display Setup* screen, select *Map Settings*:



2. With the *Main* tab selected, select an orientation for the Run screen information toolbar from the *Map Layout* drop-down list.

Tip – For a new toolbar orientation to take effect, restart the FM-1000 integrated display.

3. Select your preferred map orientation in the *Map Orientation* drop-down list:

Map orientation	Example of view	Explanation
North Up		When you perform a turn, the field remains stationary and the vehicle turns.
Vehicle Up		When you perform a turn, the field rotates but the vehicle remains pointing up.

Tip – To change the map orientation from the Run screen, tap the north arrow.

4. Select the color scheme from the *Color Scheme* drop-down list.

5. To create a save file for your work, select On from the *Save Summaries* drop-down list.

Track Logging tab

The *Track Logging* tab includes options to record the vehicle track at either a set time or a set distance.

Points along the track are logged at the greater of the two values (logging time or logging distance).

To always log a point based on either of the two values, set the other value to zero. Setting both values to zero disables Track Logging:

Setting	Description
Distance = 0, Time = 0	Track logging is turned off.
Distance = 1+, Time = 0	Track logging is recorded by distance (m).
Distance = 0, Time = >1+	Track logging is recorded by time (s).
Distance = >1+, Time = >1+	Track logging is recorded by whichever setting is higher.

Track logging files

Track logging files are created whenever you open an event. The track file records points at the rate defined in the *Mapping* screen (see the previous section). At each point, a number of attributes are recorded.

The data stored in the track logging file (Track3D_<*date time*>.dbf) is in metric units.

The information stored for each point in the track logging file is as follows:

Column	Field description	Units
Version	Track attribute file version.	–
UTC_Date	Point creation date.	YYYYMMDD
UTC_Time	UTC time.	hh:mm:ss.s
Local_Time	Local time.	hh:mm:ss.s
Logging_On	Coverage logging flag (1=on, 0=off).	On or off
Auto_Steer	Auto-Steer flag (1=on, 0=off).	On or off
GPS_Status	GPS status value (NMEA).	1, 2, 5, 4
Status_Text	GPS status description.	–
Num_Stats	Number of GPS satellites.	–
HDOP	Horizontal Dilution of Precision – A measure of the quality of positions based on satellite geometry.	–
Corct_Age	DGPS signal correction age.	seconds
Ant_Lat	Antenna latitude (WGS-84).	DD.dddddddd
Ant_Long	Antenna longitude (WGS-84).	DD.dddddddd
Height	Mean sea level height of ground.	meters
Ant_HAE	Antenna height above ellipsoid. ***Note –*** *Attribute Not Populated.*	meters
Ground_HAE	Ground height above ellipsoid. ***Note –*** *Attribute Not Populated*	meters
Speed	GPS-derived ground speed.	kph
Heading	Direction of travel with respect to true North.	decimal degrees
Swath_Num	Current swath/headland number.	
Offline	Offline distance from swath center line.	meters
Along_Line	Along line distance from start of swath. ***Note –*** *Attribute Not Populated*	meters
Swath_Wdth	Swath width.	meters
Appln_Wdth	Application width.	meters
Units	Units. ***Note –*** *Attribute Not Populated*	metric
Field_Name	The name of the field.	–
Target	The target rate at the current position.	–
As_Applied	Applied rate. ***Note –*** *Attribute Not Populated*	–
Pitch	The pitch. ***Note –*** *Attribute Not Populated*	–
Roll	The roll. ***Note –*** *Attribute Not Populated*	–
Yaw	The yaw. ***Note –*** *Attribute Not Populated*	–

Column	Field description	Units
Total_Qty	Total volume of material as applied for the current field. Only supported for the Aerial Flow Controller, Autocal Flow controller, and Crophawk Flow Meter.	–
Relative_Height	Height.	meters

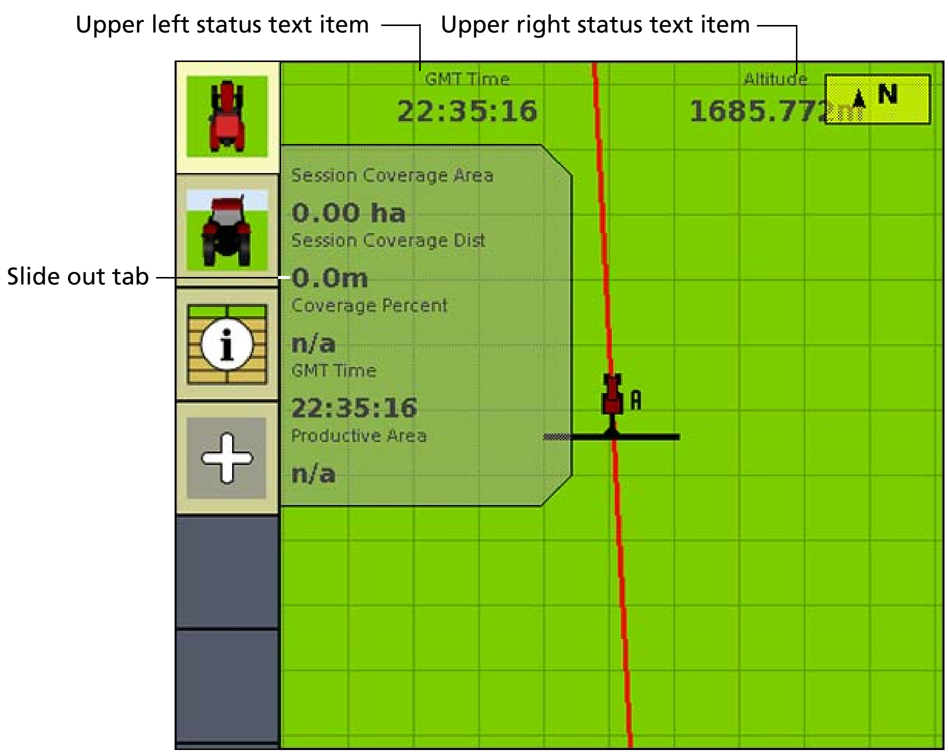
Configuring the Status Items

The *Status Items* are segments of information that can be displayed on the Run screen. The information appears in four different locations:

- In two locations at the top of the screen.
- On a slide-out tab at the left of the screen.

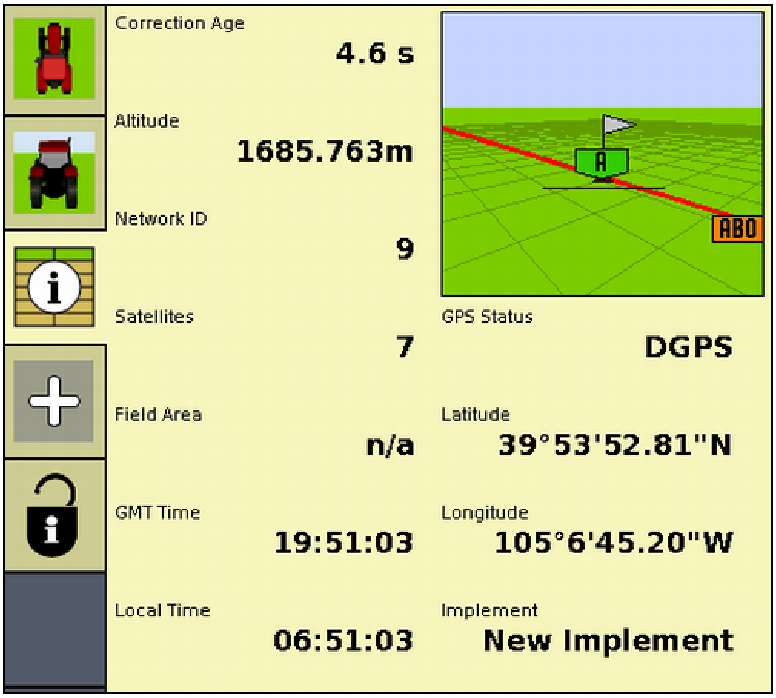
  The slide-out tab overlies the main screen, but is transparent so that you can still see guidance underneath it. To extend the slide-out tab, tap the end of the tab on the left of the screen.

  The slide-out tabs automatically slide back in when the specified time-out value is reached. To close the tab before then, tap the tab.



- On the Info screen.

  To access the Info screen, tap .



To configure which status text items appear on the Info screen, see Setting the status items, page 97.

Status items

The status items are ordered by plugin. If a plugin is removed, the items associated with it are no longer available. The available items are as follows:

Category	Item	Description
	(blank)	The status text item is not shown.
Autopilot (or Manual Guidance)	Altitude	The current height of the vehicle.
	CMR Percent	The percentage of radio CMR packets received over the last 100 seconds.
	Correction Age	The length of time since the last correction was received.
	Correction Type	The correction type that is being used.
	East	The distance that the vehicle is to the East of the field origin point (a negative number means the vehicle is to the West of the field origin point).
	Engaged Time (Autopilot only)	The length of time that the system has been engaged for.
	GPS Status	The GPS correction type that the GPS receiver is currently using.
	H Error	(Horizontal error) An estimation of the level of precision of the GPS position in 2 dimensions.
	HDOP	Horizontal Dilution of Precision: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
	Heading	The current heading of the vehicle, in degrees, from direct north.
	Latitude	The vehicle's current latitude.
	Longitude	The vehicle's current longitude.
	Network ID	The RTK network ID of the GPS receiver's corrections.
	North	The distance that the vehicle is to the North of the field origin point (a negative number means the vehicle is to the South of the field origin point).
	Nudge/Trim (Autopilot only)	The amount of Nudge or Trim currently applied.
	Offline Dist	The distance away from the guidance line.
	Satellites	The number of satellites the system is currently receiving.
	Speed	The current vehicle speed.
	Steering Angle (Autopilot only)	The angle reported by the rotary potentiometer or the AutoSense™ device.
	Up	The vertical height of the vehicle relative to the field origin point (a negative number means that the vehicle is lower than the field origin point).
	Vehicle Model (Autopilot only)	The model of vehicle that is configured.

Category	Item	Description
Mapping	Dist to Feature	The distance to the nearest feature.
	Dist to Pause	The distance to the pause position.
	Heading to Feature	Vehicle location relative to the nearest feature (feature is directly ahead = 0°, feature is directly behind = 180°).
	Heading to Pause	Direction vehicle is facing relative to the paused vehicle position (directly ahead = 0°, directly behind = 180°).
	Nearest Point Name	The name of the nearest point feature.
	Swath Length	The length of the current guidance line. ***Note –*** *FreeForm™ curves are made up of line segments, so the Swath Length value is not appropriate for FreeForm curves.*
	Swath Number	The swath number (L=left, R=right). ***Note –*** *FreeForm curves are made up of line segments, so the Swath Number value is not appropriate for counting FreeForm curves.*
	Swath Points	The number of points that define the current line.

Category	Item	Description
Tru Application Control	Average Population	The average rate across all rows.
	Avg. Seed Spacing	The average spacing between the planted seeds (across all of the rows).
	Control Speed	The speed reported to the multi-application controller.

Category	Item	Description
System	Available Memory	The available internal memory in the display.
	Coverage Percent	The percentage of the field area that is covered area.
	Event Coverage Area	The area that has been logged during the current event.
	Event Coverage Distance	The distance covered while logging during the current event.
	Event Coverage Time	The length of time that coverage logging has been engaged for during the current event.
	Field Area	The field area within a pivot or headland boundary.
	Free External Storage	The amount of free space on the USB memory stick.
	Free Internal Storage	The amount of free space on the display's built in memory space.
	GMT Time	The current Greenwich Mean Time.
	Implement	The name of the current implement.
	Implement F/B Offset	Distance of front to back offset.
	Implement L/R Offset	Distance left to right offset.
	Implement Width	Width of the implement.
	Local Time	The local time.
	Productive Area	The area of Area Features that are designated as "productive".

Category	Item	Description
	Session Coverage Area	The area that has been logged during the current session.
	Session Coverage Dist	The distance covered while logging during the current session.
	Session Coverage Time	The length of time that coverage logging has been engaged for during the current session.
	Session Time	The length of the current field session.

Category	Item	Description
EZ-Boom	Applied Rate	The current rate.
	Area to Empty	The area that can still be sprayed before the tank is empty.
	Current Flow	The current flow of the EZ-Boom system.
	Pressure	The current pressure, as reported by the primary pressure sensor.
	Secondary Pressure	The current pressure, as reported by the secondary pressure sensor.
	Tank Level	The current level of the sprayer’s tank.
	Target Rate	The spraying target rate.
	Total Vol Applied	The total volume of solution applied.

Category	Item	Description
TrueTracker	Impl. Altitude	The current height of the implement.
	Impl. CMR Percent	The percentage of radio CMR packets received over the last 100 seconds by the implement GPS receiver.
	Impl. Correction Age	The age of the corrections used by the implement receiver.
	Impl. Correction Type	The correction type used by the implement receiver.
	Impl. East	The distance that the implement is to the East of the field origin point (a negative number means the vehicle is to the West of the field origin point).
	Impl. Engaged Time	The time that the implement has been engaged.
	Impl. GPS Status	The status of the GPS correction used for the implement.
	Impl. H Error	(Horizontal error) An estimation of the level of precision of the implement GPS position in 2 dimensions.
	Impl. HDOP	The Horizontal Dilution of Precision of the implement receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
	Impl. Latitude	The implement's current latitude.
	Impl. Longitude	The implement's current longitude.
	Impl. Network ID	The RTK network ID of the implement receiver's corrections.
	Impl. North	The distance that the implement is to the North of the field origin point (a negative number means the vehicle is to the South of the field origin point).
	Impl. Nudge/Trim	The amount of Nudge or Trim currently applied to the implement position.
	Impl. Offline Dist	The implement offline distance.
	Impl. Satellites	The number of satellites that the implement receiver is reading.
	Impl. Speed	The speed of the implement.
	Impl. Steering Angle	The steering angle of the implement.
	Impl. Up	The vertical height of the implement relative to the field origin point (a negative number means the vehicle is below the field origin point).
	Impl. Vehicle Model	The implement profile name.

Category	Item	Description
Serial Rate Control	Applied Rate	The applied rate.
	Current Flow	The current flow.
	Target Rate	The current target rate.
	Total Vol Applied	The total volume applied so far.

Category	Item	Description
FieldLevel	P Altitude	The current height of the vehicle (as reported by the blade GPS receiver).
	P Blade Height	The current height of the blade.
	P CMR Percent	The percentage of radio CMR packets received over the last 100 seconds by the blade GPS receiver.
	P Correction Age	The time since the GPS corrections were last received from the FieldLevel GPS receiver.
	P Correction Type	The correction type used by the blade receiver.
	P Cut/Fill	The difference between the Blade Height and the Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
	P Design Height	The height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
	P Distance Traveled	(For use with Point to Slope mode). The distance traveled since Auto mode was enabled.
	P East	The distance that the blade receiver is to the East of the field origin point (a negative number means the vehicle is to the West of the field origin point).
	P GPS Status	The GPS correction type that the blade GPS receiver is currently using.

Category	Item	Description
	P H Error	(Horizontal error) An estimation of the level of precision of the blade GPS position in 2 dimensions.
	P HDOP	The current Horizontal Dilution of Precision of the blade receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
	P Heading	The current heading of the blade in degrees from direct north.
	P Latitude	The blade’s current latitude.
	P Longitude	The blade’s current longitude.
	P Network ID	The RTK network ID of the blade receiver’s corrections.
	P North	The distance that the blade receiver is to the North of the field origin point (a negative number means the vehicle is to the South of the field origin point).
	P Offset	A separate plane that is parallel to the design plane. The offset is defined by a single measurement, which is the height that the offset plane is from the design plane.
	P Offset X	The Relative Position X offset from the master benchmark.
	P Offset Y	The Relative Position Y offset from the master benchmark.
	P Satellites	The number of satellites currently being received by the FieldLevel GPS receiver.
	P Speed	The speed of the vehicle as reported by the blade GPS receiver.
	P Target Height	The height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
	P Up	The height of the blade receiver relative to the field origin point (a negative number means the blade is below the field origin point).
	P VDOP	The current VDOP of the FieldLevel GPS receiver.
	P Vertical Error Estimate	The current estimate of error in the height calculated by the FieldLevel GPS receiver.

Category	Item	Description
FieldLevel II Tandem/Dual	S Altitude	The current height of the vehicle (as reported by the blade GPS receiver).
	S Blade Height	The current height of the blade.
	S CMR Percent	The percentage of radio CMR packets received over the last 100 seconds by the blade GPS receiver.
	S Correction Age	The time since the GPS corrections were last received from the FieldLevel GPS receiver.
	S Correction Type	The correction type used by the blade receiver.
	S Cut/Fill	The difference between the Blade Height and the Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
	S Design Height	The height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
	S Distance Traveled	(For use with Point to Slope mode). The distance traveled since Auto mode was enabled.
	S East	The distance that the blade receiver is to the East of the field origin point (a negative number means the vehicle is to the West of the field origin point).
	S GPS Status	The GPS correction type that the blade GPS receiver is currently using.
	S H Error	(Horizontal error) An estimation of the level of precision of the blade GPS position in 2 dimensions.
	S HDOP	The current Horizontal Dilution of Precision of the blade receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
	S Heading	The current heading of the blade in degrees from direct north.
	S Latitude	The blade’s current latitude.
	S Longitude	The blade’s current longitude.
	S Network ID	The RTK network ID of the blade receiver’s corrections.
	S North	The distance that the blade receiver is to the North of the field origin point (a negative number means the vehicle is to the South of the field origin point).
	S Offset	A separate plane that is parallel to the design plane. The offset is defined by a single measurement, which is the height that the offset plane is from the design plane.
	S Offset X	The Relative Position X offset from the master benchmark.
	S Offset Y	The Relative Position Y offset from the master benchmark.

Category	Item	Description
	S Satellites	The number of satellites currently being received by the FieldLevel GPS receiver.
	S Speed	The speed of the vehicle as reported by the blade GPS receiver.
	S Target Height	The height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
	S Up	The height of the blade receiver relative to the field origin point (a negative number means the blade is below the field origin point).
	S VDOP	The current VDOP of the FieldLevel GPS receiver.
	S Vertical Error Estimate	The current estimate of error in the height calculated by the FieldLevel GPS receiver.

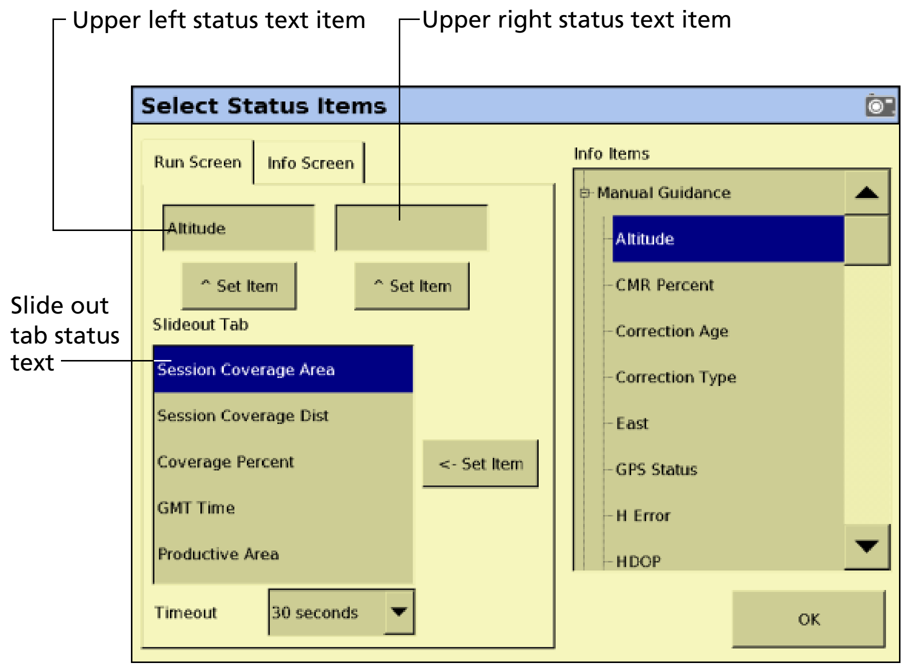
Category	Item	Description
FieldLevel Survey/Design	Blade Height	The current height of the blade.
	Cut/Fill	The difference between the Blade Height and the Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
	Design Height	The height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
	Offset X	The Relative Position X offset from the master benchmark.
	Offset Y	The Relative Position Y offset from the master benchmark.
	Survey Points	The number of survey points that have been created.
	VDOP	The current VDOP of the FieldLevel GPS receiver.
	Vertical Error Estimate	The current estimate of error in the height calculated by the FieldLevel GPS receiver.

Setting the status items

To set the status items:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.

4. In the *Display Setup* screen, select **Status Items** and then tap *Setup*:



The *Select Status Items* screen has two tabs that enable you to configure various display options for the status text items.

The Run Screen tab

The *Run Screen* tab lets you allocate the various items that will be displayed on the Run screen.

The status text items appropriate for your current plugins appear in the *Info Items* list.

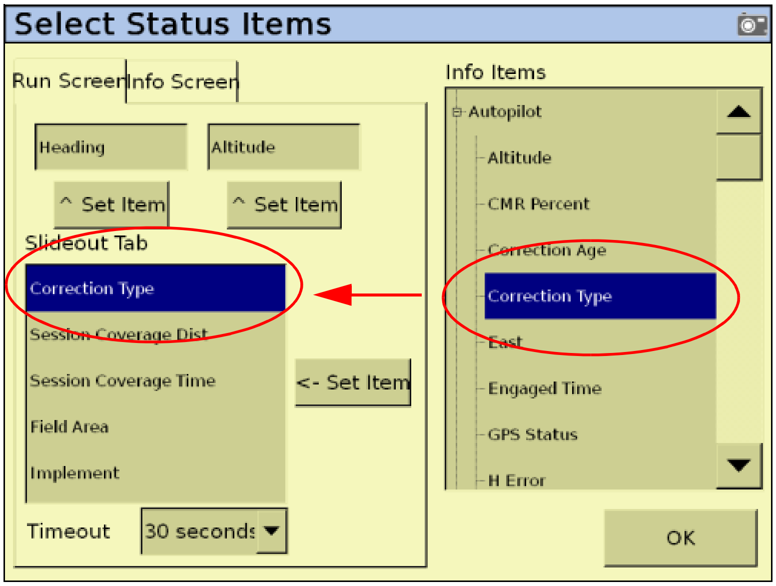
1. Set the upper left status text item:
   a. In the *Info Items* list, tap the item you want to use.
   b. Tap the left **^ Set Item** button.

      The information appears in the upper left field.
2. Set the upper right status text item:
   a. In the *Info Items* list, tap the item you want to use.
   b. Tap the right **^ Set Item** button.

      The information appears in the upper right field.
3. In the *Timeout* list, select a time. This is how long the tab remains on-screen before retracting. To have the tab extended until you close it manually, select *Never*.

4. To add status items to the slide-out tab:

   a. Tap the position on the tab that you want to fill. For example, to add an item to the first position on the list, tap at the location shown:



   b. In the *Info Items* list, tap the item you want to use.

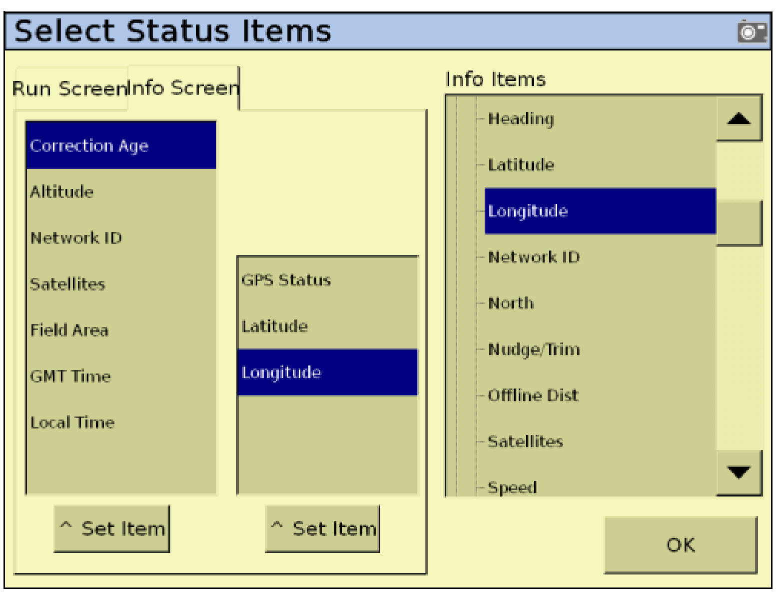
   c. Tap **<- Set Item**.

   d. To save the configuration, tap **OK**.

The Info Screen tab

The *Info Screen* tab lets you allocate which items will be displayed on the Info screen.

The status text items appropriate for your current plugins appear in the *Info Items* list.



1. Set the left Info text items:
   a. In the *Info Items* list, tap the item you want to use.
   b. Tap the left **^ Set Item** button.
   c. Repeat Step a and Step b until you have all the items you require, or the list is full.

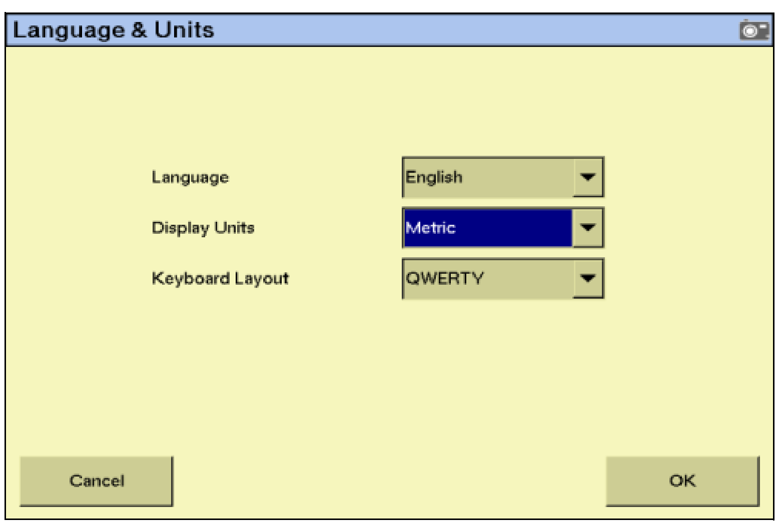
      The information appears in the left field.
2. Set the right Info text items:
   a. In the *Info Items* list, tap the item you want to use.
   b. Tap the right **^ Set Item** button.
   c. Repeat Step a and Step b until you have all the items you require, or the list is full.

      The information appears in the right field.
   d. To save the configuration, tap **OK**.

Selecting the language, units of measure, and keyboard layout

To select the default language for the display:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. In the *Display Setup* screen, select *Language & Units* and then tap **SETUP**. The *Language & Units* setup screen appears:



5. Select the language to use from the *Language* drop-down list.

If you change the language, a message warns that the display will turn off so that the change can take effect.

The default language is English.

6. To select the unit of measure for the display, select the preferred option from the *Display Units* drop-down list:

   – Metric

   – Feet and Inches

   – Decimal Feet

   The default option is Feet and Inches.

7. Set the keyboard layout.

   The FM-1000 integrated display uses a virtual keyboard on the touch screen for you to enter characters (see page 27).

   The virtual keyboard can be laid out in two ways:

Setting	Description
ABCDEF	The letters appear in alphabetical order.
QWERTY	The keyboard is laid out like the Qwerty keyboard on a computer.

   Select your preferred option from the *Keyboard Layout* drop-down list.

   The default option is ABCDEF.

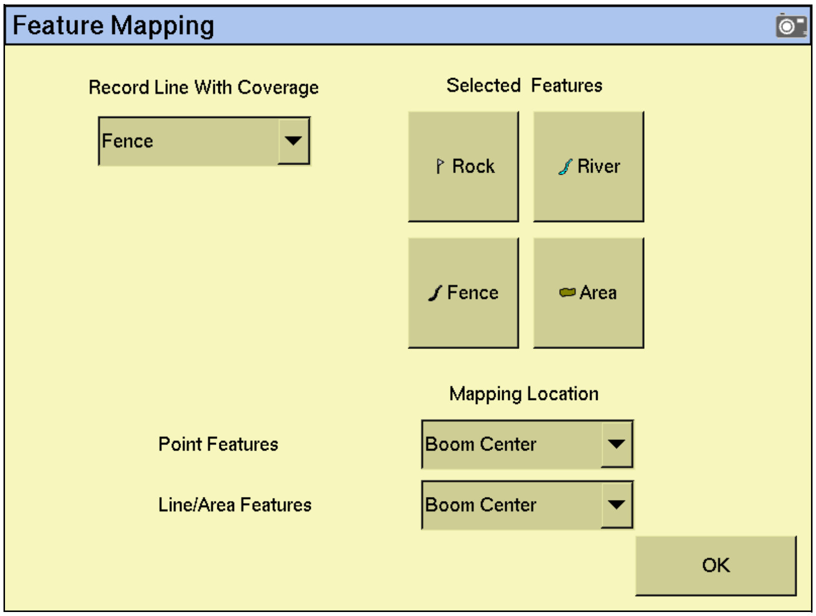
Restoring factory default settings

To restore the settings of the FM-1000 integrated display to the factory default settings, select *Default Settings* and then tap **Restore**.

Configuring feature mapping

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.

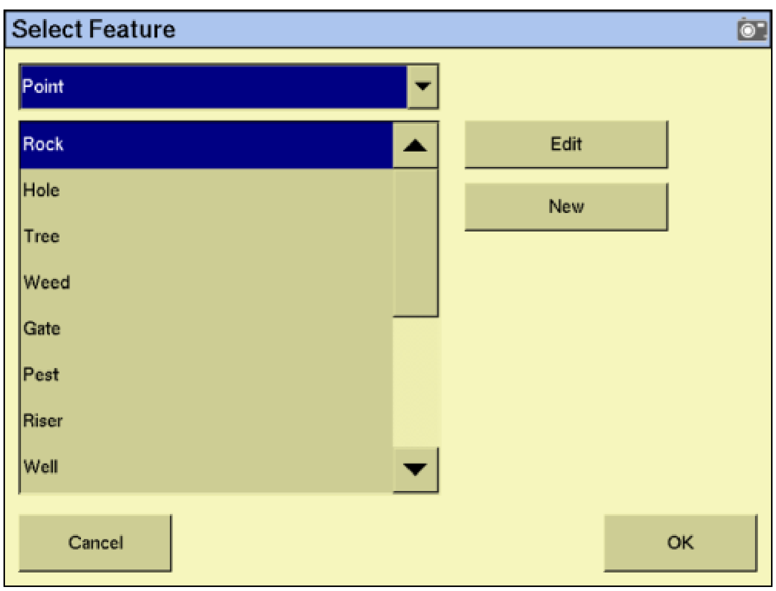
4. From the *Display Setup* screen, select *Feature Mapping* and then tap **Setup**:



The four large buttons represent the field feature buttons that appear on the *Mapping* tab on the Run screen (see The Run screen layout, page 49).

5. In the *Mapping Location* group, select *Boom Left*, *Boom Center*, or *Boom Right* as the point on the vehicle where the feature will be created:
   - For a Point feature, select from the *Point Features* drop-down list.
   - For a Line or Area feature, select from the *Line/Area Features* drop-down list.

6. Select one of the four feature buttons to assign a feature to:



7. Do one of the following:
   - To create a new feature and assign it to the button, select the type of feature to create (point, line, or area) from the drop-down list and then tap **New**. The *Edit Feature* screen appears.
   - To assign an existing feature to the button, select the type of feature to edit (point, line, or area), select the feature from the list that appears and then tap **OK**. The *Select Active Feature* screen reappears with the feature that you selected assigned to the feature button.

Creating a point feature

1. Enter values for the following settings.

Item	Description
Name	The name of the feature. For example, “Tree”.
Alarm Radius	When the vehicle comes within this radius of the feature, the alarm appears. The alarm radius appears on the screen as a solid red block of color. The alarm radius is more serious than the warning radius, so set it to a shorter distance.
Warning Radius	The distance around the feature that causes a warning message to appear. The warning radius appears on the screen as an orange line.
Average Position	This is a way to improve the quality of the point feature position. • If you select the **Average Position** button, the display calculates the average position of the feature over 30 seconds. • If you deselect the button, the display places the feature at the coordinates that the vehicle is at when you tap the button.

2. To select the feature appearance color, tap **Color**.
3. To return to the *Select Feature* screen, tap **OK**.

   The new feature appears in the *Point* list.
4. Select the new feature from the list and then tap **OK**.

   The new feature appears on the button you selected.
5. To exit, tap **OK**.

Creating a line feature

1. In the *Name* field, enter a name for the feature.
2. To select the feature appearance color, tap **Color**.
3. To return to the *Select Feature* screen, tap **OK**.

   The new line feature appears in the *Line* list.
4. Select the new feature in the list and then tap **OK**.

The new feature appears on the button you selected.

5. Tap **OK**.

Creating an area feature

You can use area features to define areas of land as ***Productive*** or ***Unproductive***. If the sprayer passes into an area that is defined as unproductive, the boom sections turns off. This can be useful for setting exclusion zones that you do not want to spray, for example, waterways.

1. In the *Name* field, enter the name of the feature.
2. If the area feature will be a section of land that can be included in area calculations, set the **Productive Area** button to *Yes*. If it is unproductive land, set the button to *No*.
3. To select the feature appearance color, tap **Color**.
4. If a signal pin is attached to the system, set the **Remote Output** button to *Enabled*. This enables you to trigger a pulse to an external device when you enter or exit this area.
5. From the *Trigger Warning* list, select one of the following settings.

Item	Description
No Warning	No warning appears
Entering Area	A warning appears while you are inside the area
Leaving Area	A warning appears while you are outside the area

Note – *The Remote Output and Trigger Warning settings relate* ***only*** *to this type of area feature. They do not apply to any of your other area features. You must set the warning for each type of area feature individually.*

6. Tap **OK**.

   The new area feature appears in the *Area* list.

7. Select the new feature from the list and then tap **OK**.

   The new feature appears on the button you selected.

8. Tap **OK**.

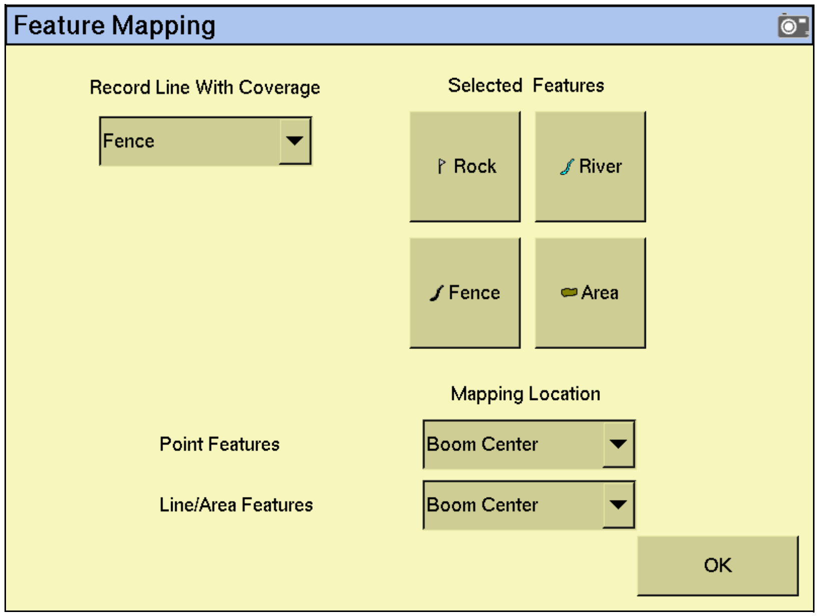
For more information on applying field features during navigation, see Placing field features on screen, page 67.

Activating field boundaries

The FM-1000 integrated display includes the field boundary feature that enables you to map multiple-bounded areas within a field.

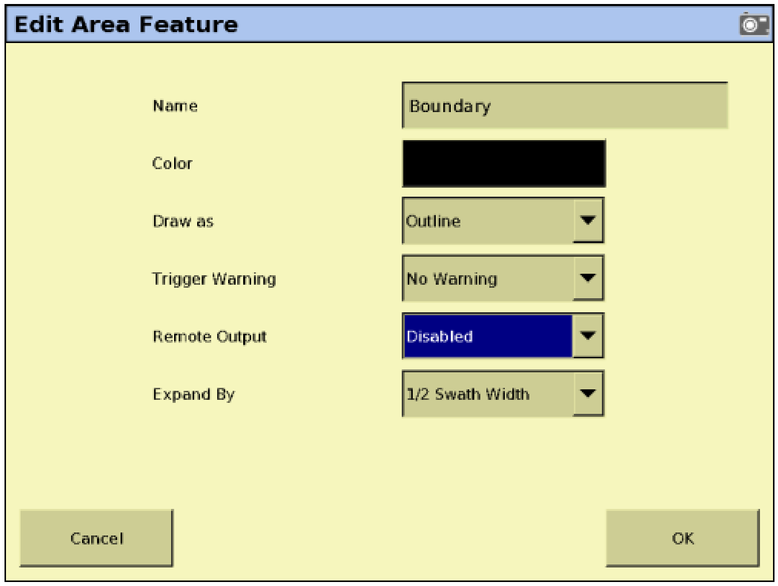
Field boundaries create a separate boundary file that can be used to calculate area and control automatic section switching at the edge of the field.

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. From the *Display Setup* screen, select *Feature Mapping* and then tap **Setup**:



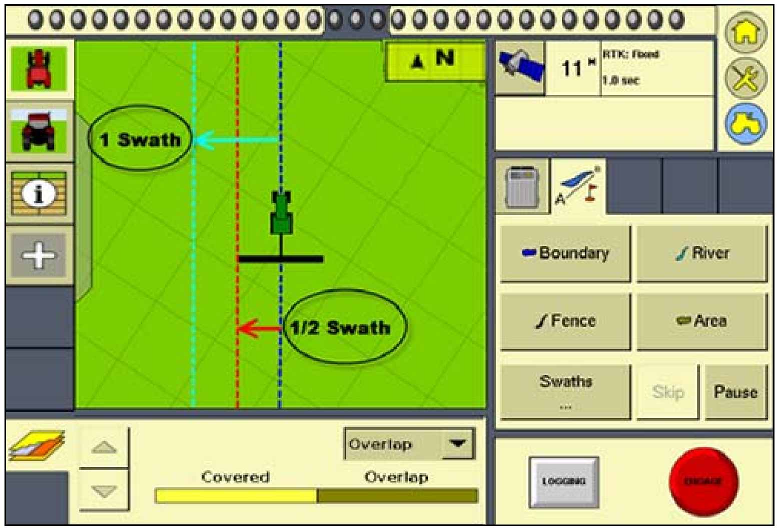
5. Tap one of the *Selected Features* buttons. The *Select Feature* screen appears.
6. From the feature drop-down list, select *Area* and then tap **New**.

7. From the list of features, select *Boundary* and then tap **Edit**:



8. Set one or more of the following the attributes for the boundary features.

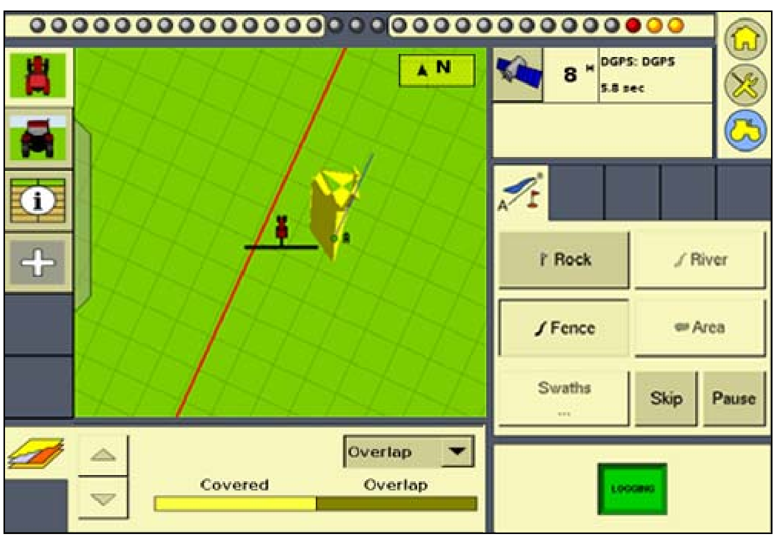
Attribute	**Description**
Name	a custom name that appears on the *Feature Mapping* tab.
Color	sets the color of the boundary outline and also the infill color, if selected.
Area Type	set to either Productive or Non-productive
Trigger Warning	sets a visual and audible warning when entering or leaving the boundary edge.
Remote Output	when enabled, this feature restricts remote output pulses from being triggered while outside the boundary.
Expand By (See the following image)	Sets how the boundary is actually recorded: • Nothing: Maps the boundary exactly at the recorded position. • ½ Swath Width: Expands the recorded boundary location by ½ the swath width after the boundary is closed. • 1 Swath Width: Expands the recorded boundary location by 1 additional swath width after the boundary is closed.



9. Tap **OK**. The *Select Feature* screen appears.
10. Tap **OK**. The *Feature Mapping* screen appears.
11. Tap **OK**. The *Display Setup* screen appears.
12. Tap **OK**.

Recording a line feature with coverage logging

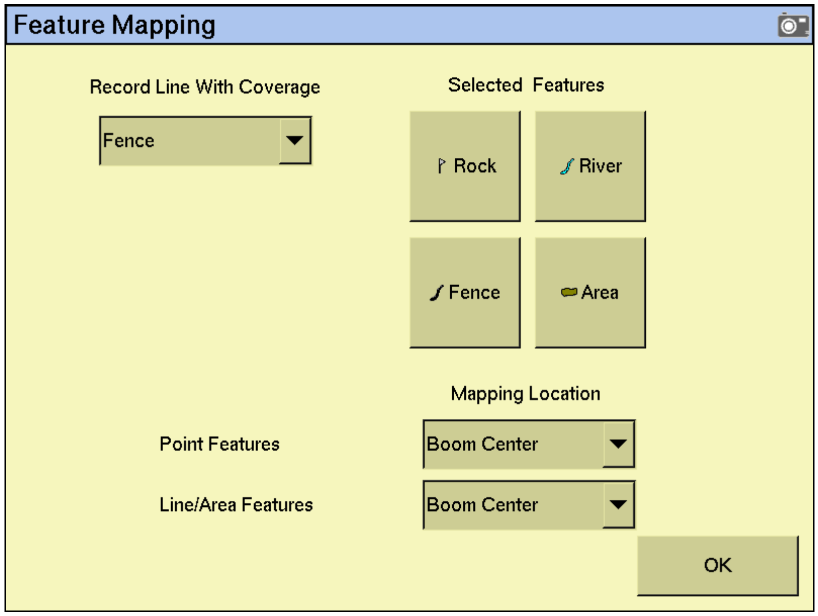
With the FM-1000 integrated display, you can record a line feature simultaneously with coverage logging:



To activate line feature mapping:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.

3. Select the System option and then tap **Setup**.
4. From the *Display Setup* screen, select *Feature Mapping* and then tap **Setup**:



5. Tap one of the four feature buttons to create or select an active line feature and then tap **OK**.
6. From the *Record Line With Coverage* drop-down list, select the required line feature and then tap **OK**. The *Display Setup* screen appears.
7. Tap **OK**.

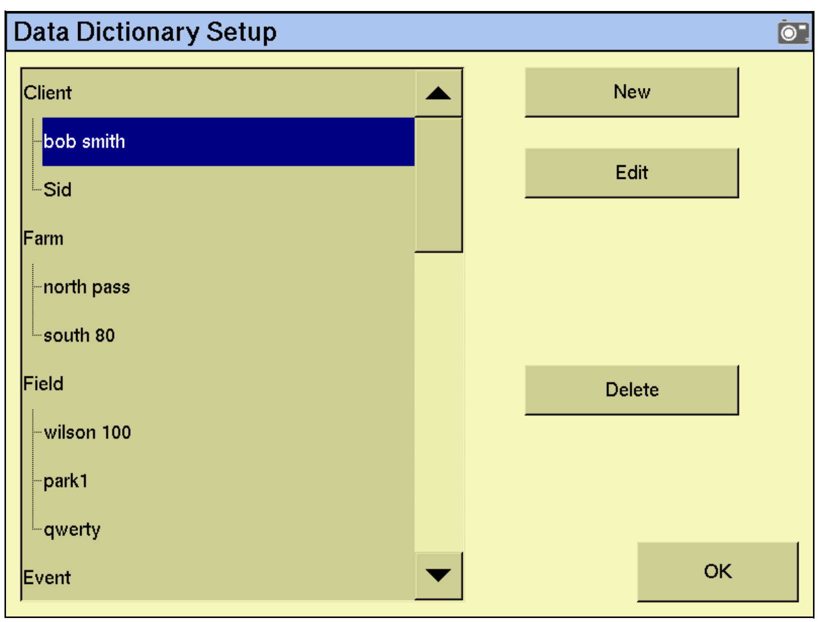
Editing the Data Dictionary

The data dictionary editor enables you to predefine the entry options defined below and then select them from a pick-list during field and event definition.

Data dictionary entry fields

Client	Implement	Target pests
Farm	Application method	Custom 1
Field	Wind speed	Custom 2
Event	Wind gust speed	Custom 3
Operator	Wind direction	Custom 4
Operator EPA #	Sky conditions	Material
Harvest year	Soil conditions	Stoppage reason
Farm location	Soil type	
Vehicle	Crop	

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. From the *Display Setup* screen, select *Data Dictionary* and then tap **Setup**:



5. From the data list, select the data field to define and then tap either **New** or **Edit**.
6. Define the custom entry by manually entering or updating the name and then tap **OK**.

The new or edited entry appears in the data list on the *Data Dictionary Setup* screen.

For more information on editing data dictionary entries, see Data dictionaries, page 634.

For more information on accessing data dictionary entries, see Accessing data dictionary entries, page 46.

Configuring the lightbar settings

The display has two lightbar options:

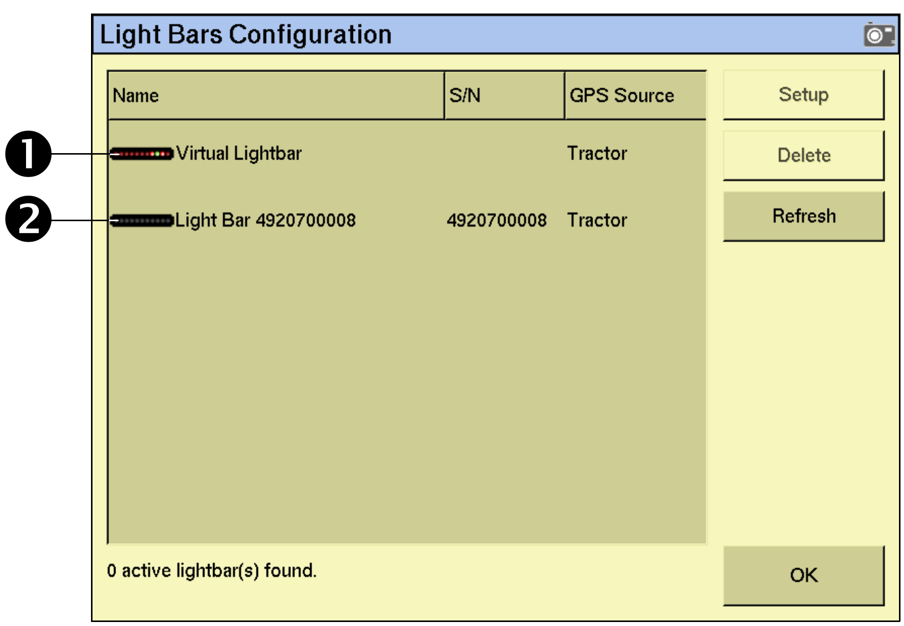
- the virtual lightbar that appears at the top of the display's Run screen
- one, or more external lightbars; for more information, see Chapter 23, The LB25 External Lightbar.

Configuring the virtual lightbar

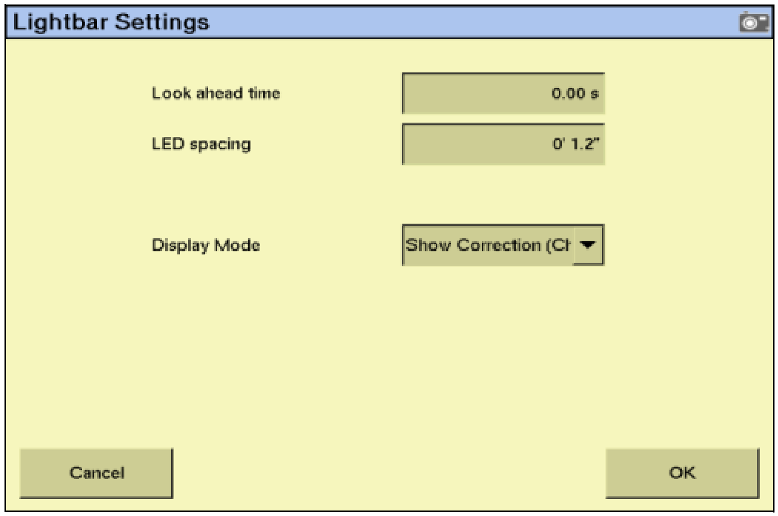
The FM-1000 integrated display has default settings for the virtual1 lightbar that should suit most drivers. If the settings are not appropriate, configure the lightbar as follows:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. From the *Display Setup* screen, select *Lightbar* and then tap **Setup**.

   In the *Light Bars Configuration* screen the virtual lightbar from the FM-1000 integrated display is shown ❶, along with any detected external lightbars ❷:



5. Select the *Virtual Lightbar* and then tap **Setup**:



Configure the following settings:

Setting	Affects...	Default setting	This setting determines...
Look ahead time	EZ-Guide® Plus lightbar	0 seconds	the distance ahead of the vehicle that the lightbar will use for LED guidance and offline distance.
LED spacing	Virtual lightbar and EZ-Guide Plus lightbar	3 cm per LED/1" per LED	the distance represented by each LED on the lightbar.
Display Mode	Virtual lightbar and EZ-Guide Plus lightbar	show error (chase mode)	how the LEDs respond to offline distances. When "Show error" is selected, the display shows the direction that you need to move in. When "Show correction" is selected, the display shows your current distance offline.

To set the look ahead time or the LED spacing:

1. Tap the appropriate number field.
2. In the dialog that appears, enter the required values.

To set the display mode:

1. From the *Display Mode* drop-down list, select the required option.
2. Enter the virtual lightbar settings and then tap **OK**. The *Lightbars Configuration* screen appears.
3. Tap **OK**.

The virtual lightbar is now configured.

Configuring the EZ-Remote options

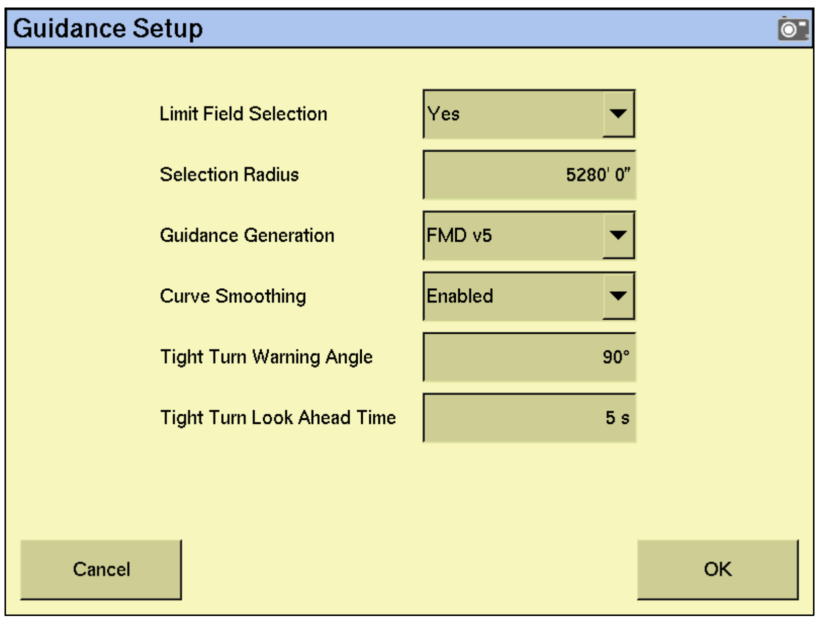
For more information on installing and configuring the EZ-Remote joystick, see Chapter 22, The EZ-Remote Joystick.

Configuring the guidance options

Selecting *Guidance* enables you to configure advanced guidance settings. If you are setting up the system for the first time, you should not need to adjust these settings.

Enabling the Limit Field Selection filter

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. From *Display Setup* screen, select *Guidance* and then tap **Setup**:

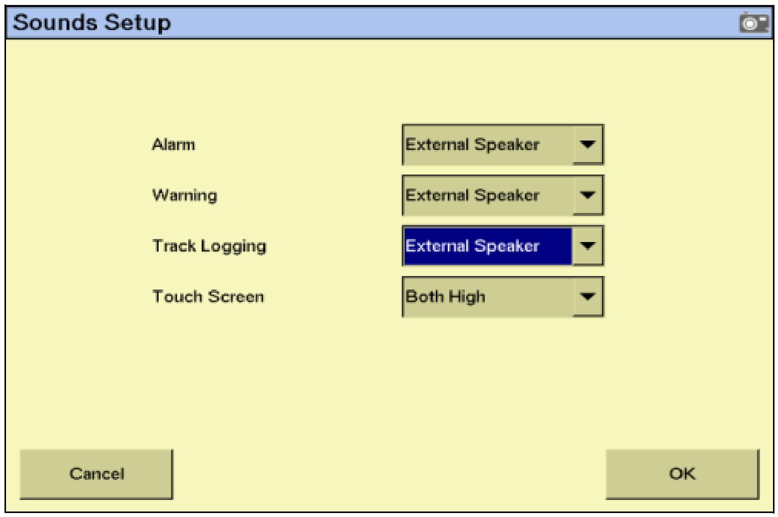


5. From the *Limit Field Selection* drop-down list, select the preferred option.
6. If you selected *Yes* at Step 5, the *Selection Radius* dialog appears. Enter the required radius value and then tap **OK**.
7. In the *Display Setup* screen, tap **OK**.

To review the settings, or if you have any guidance lines originally generated with an *Ag*GPS 170 Field Computer or an FieldManager™ display, see Advanced diagnostics, page 638.

Configuring sounds

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.
4. From the *Display Setup* screen, select *Sounds* and then tap **Setup**:



There are two ways that the display can produce sounds:

– FM-1000: through an optional external speaker

– Sonalert: through an optional Sonalert alarm

5. To enable a sound, select the required option from the drop-down list and then tap **OK**.

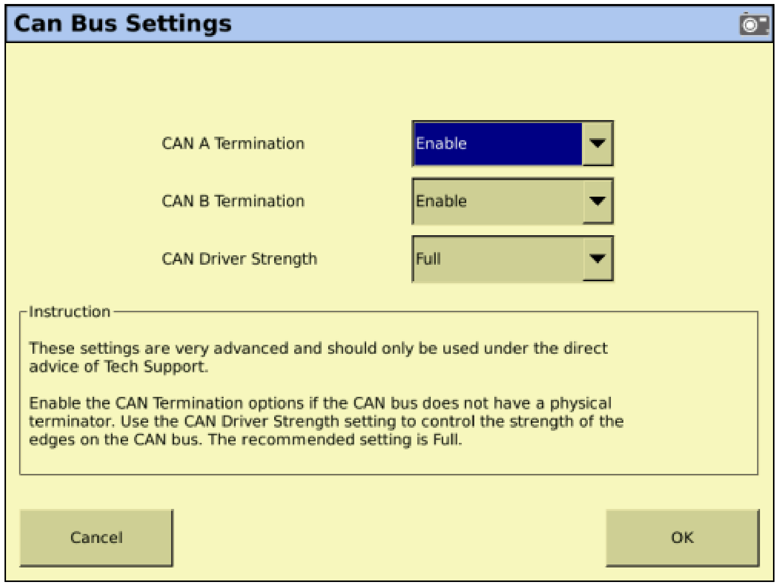
Configuring the CAN bus

***Note** – These settings are very advanced; use them only under the direct advice of Trimble Technical Support.*

The FM-1000 integrated display features advanced power management features to dim the backlight or turn off the display after a pre-set period of inactivity.

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.

4. From the *Display Setup* screen, select *CAN Bus Settings* and then tap **Setup**:



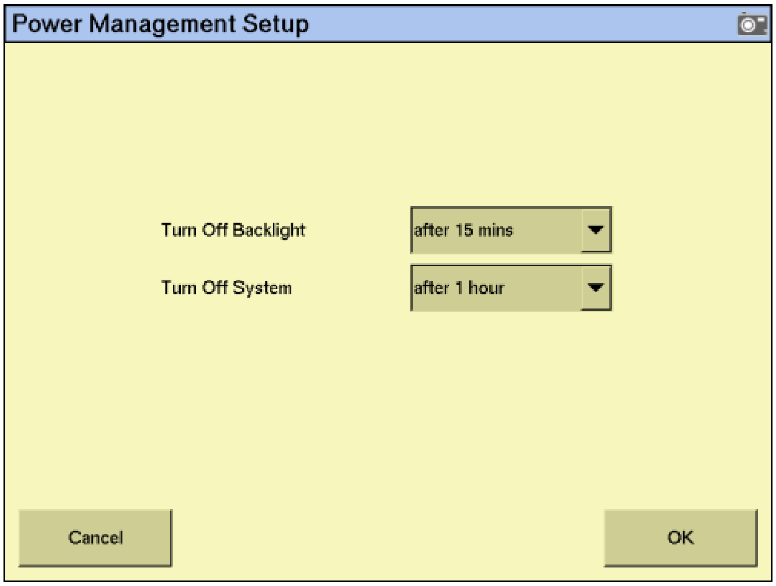
5. If the either the A or B CAN buses do not have a physical terminator, enable the *CAN Termination* option for that bus.
6. To control the strength of the edges on the CAN bus, enable the *CAN Driver Strength* setting. Trimble recommends that you set the *CAN driver Strength* to *Full*.
7. Tap **OK**.

Configuring power management

The FM-1000 integrated display features advanced power management features to dim the backlight or turn off the display after a pre-set period of inactivity.

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.

4. From the *Display Setup* screen, select *Power Management* and then tap **Setup**:



5. From the *Turn Off Backlight* drop-down list, select the required period of inactivity until the backlight dims.
6. From the *Turn Off System* drop-down list, select the required period of inactivity until the display shuts down.
7. Tap **OK**.

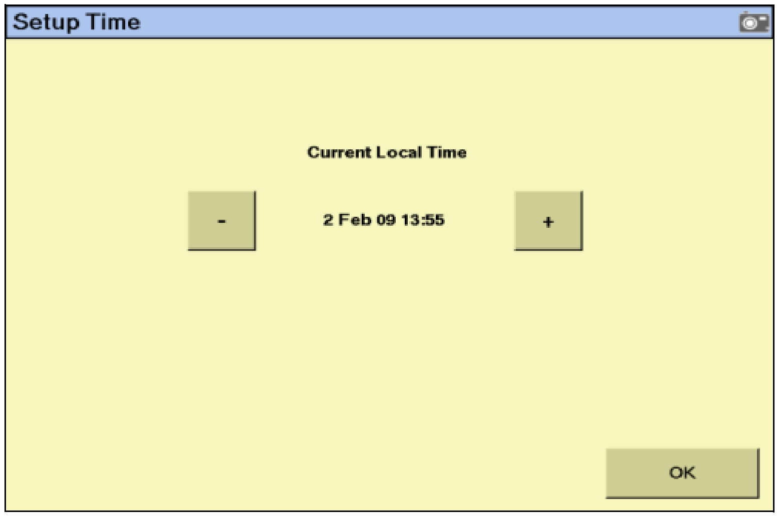
Configuring the system time

Note – *Configuring the time zone can cause multiple warning messages to appear. Do not be concerned by this.*

To synchronize the system time to the GPS signals:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the System option and then tap **Setup**.

4. From the *Display Setup* screen, select *Timezone* and then tap **Setup**:

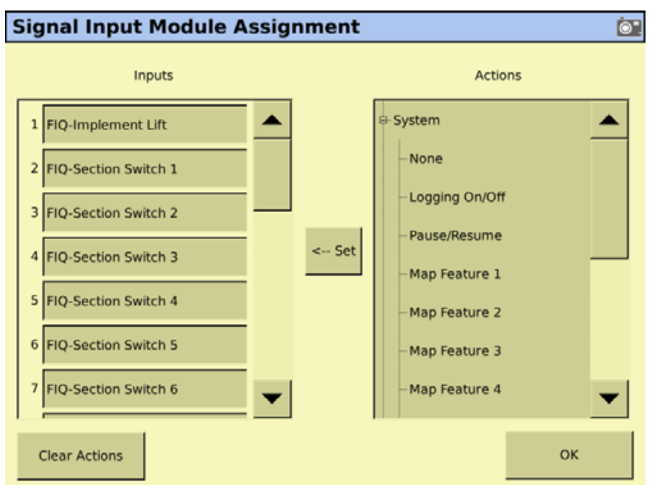


5. If the time is not correct, tap the **-** or **+** button to change the time by 1-hour increments.
6. When the time matches the local time, tap **OK**.

Signal input module for an OEM switch interface

The new signal input module (SIM) can interface with existing equipment inputs to control on-screen buttons and features.

- A SIM must be connected to assign features to the buttons:



CHAPTER

5

Vehicle Guidance Options

In this chapter:

- Manual guidance
- Autopilot automated steering system guidance
- EZ-Steer assisted steering system guidance

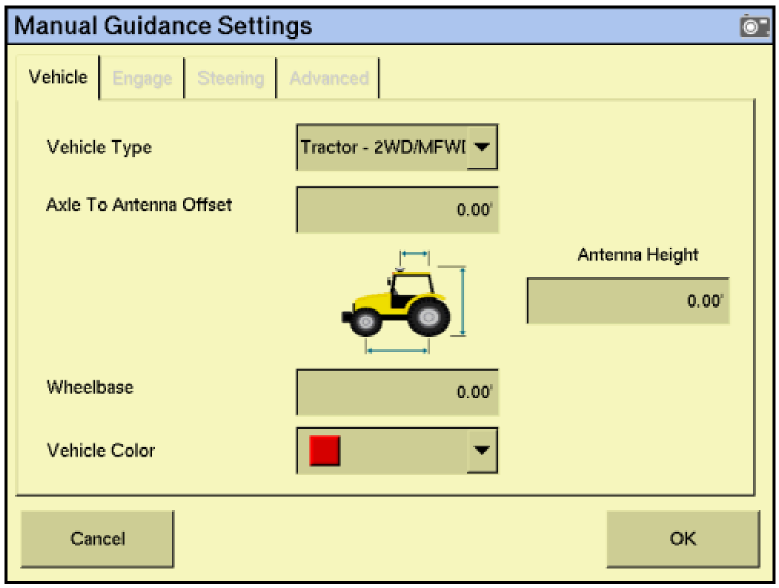
You must configure the vehicle guidance settings before using the FM-1000 integrated display. Vehicle guidance is controlled by either the manual guidance option, the Autopilot automated steering system option, the FieldLevel II plugins, or the EZ-Steer system plugin.

Several of these guidance options incorporate GPS receivers; for more information, see Chapter 6, The GPS Receiver.

Manual guidance

Manual guidance setup options enable you to configure the onscreen vehicle appearance and color:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the plugin and then tap **Setup**:



4. To change the vehicle's on-screen appearance, select a vehicle type from the drop-down list.
5. Select the *Axle to Antenna Offset* list, read the on-screen message and then tap **OK**.
6. Enter an axle to antenna offset value and then tap **OK**.
7. Select the *Antenna Height* list.
8. Enter an antenna height value and then tap **OK**.

Note – Measure the antenna height vertically, from the ground to the base of the antenna.

9. Select the *Wheelbase* list.
10. Enter a wheelbase value and then tap **OK**.
11. In the *Vehicle Color* list, select the preferred color for the vehicle icon that appears on the Run screen.
12. Tap **OK**.

Note – Any changes that you make to the vehicle color or appearance remain even if you remove the Manual Guidance option and replace it with the Autopilot option.

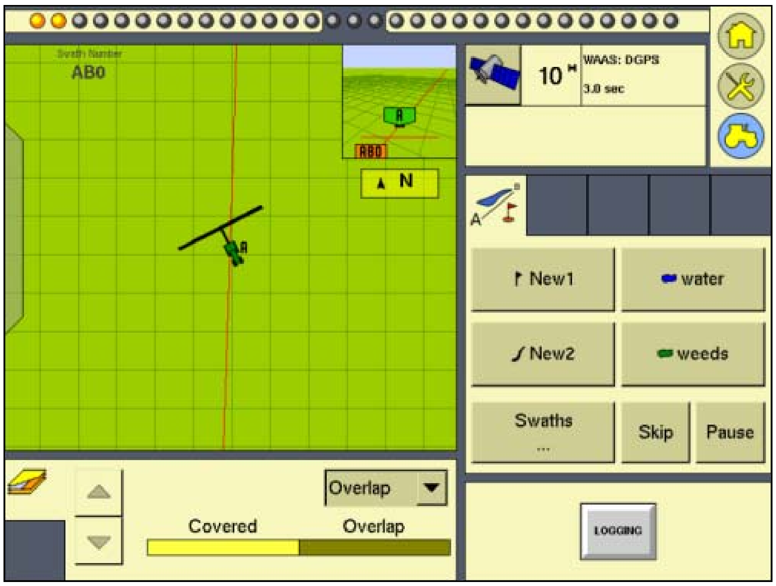
Configuring the GPS receiver

When you install the Manual Guidance option, the GPS Receiver option is also installed. For instructions on configuring the GPS receiver, see Chapter 6, The GPS Receiver.

Run screen for manual guidance

When you use the Manual Guidance option, the Run screen looks similar to when the Autopilot option is installed, except that:

- there is no *Autopilot* tab on the right
- there is no **Engage** button



You can still access the Mapping plugin to add field features or create guidance lines.

Since there is no Autopilot system to control steering, you must steer the vehicle manually while you watch the virtual lightbar for guidance.

Autopilot automated steering system guidance

Prior to configuration, the Autopilot option must be installed on the FM-1000 integrated display. For more information, see the *FM-1000 integrated display Plug-ins Guide*.

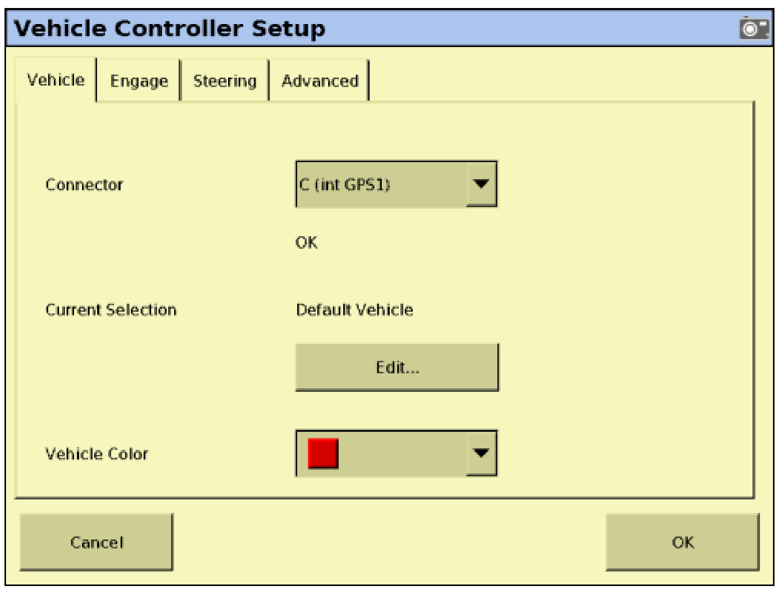
There are two stages to configuring the Autopilot option:

- Configure the vehicle (select the current vehicle make and model).
- Calibrate the Autopilot automated steering system for your vehicle.

***Note** – The following configuration steps are usually done when the system is professionally installed.*

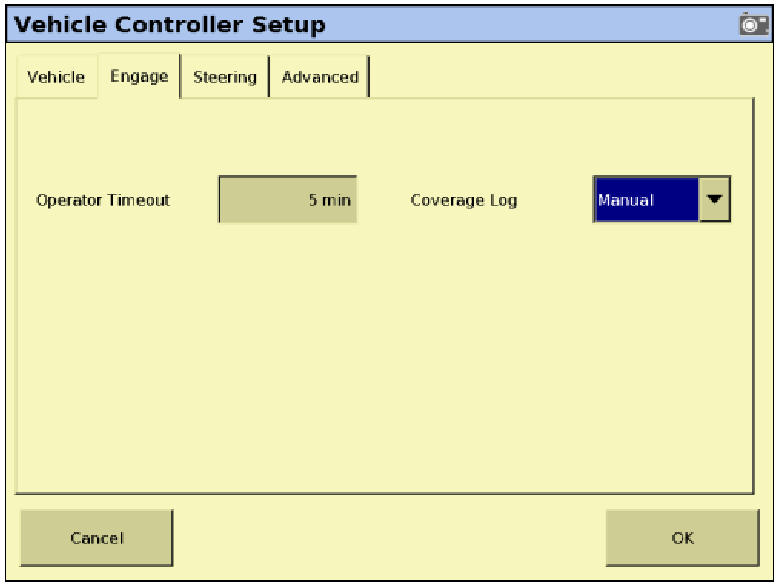
Configuring the Vehicle tab

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the Autopilot option and then tap **Setup**:



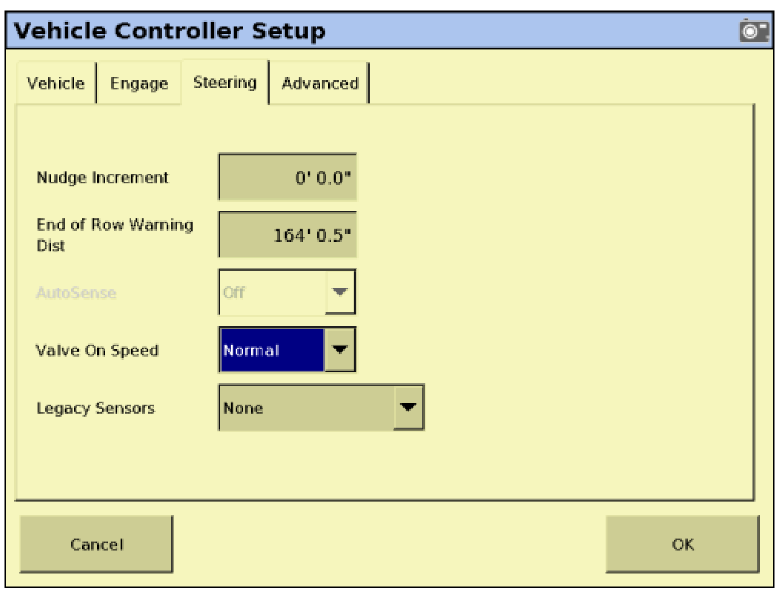
4. In the *Connector* list, select the port on the FM-1000 integrated display that the Autopilot system controller is connected to.
5. The *Current Selection* displays the current vehicle (.vdb) profile that is loaded on the display. To change this setting, see Selecting the vehicle, page 123.
6. In the *Vehicle Color* list, select the preferred color for the vehicle icon that appears on the Run screen.

Configuring the Engage tab



1. In the *Engage* tab, select Operator Timeout.
2. In the *Enter The EZ-Steer Operator Timeout* screen, enter a value and then tap **OK**.
3. In the *Coverage Log* list, select either Manual, or When Engaged.

Configuring the Steering tab



1. In the *Steering* tab, select Nudge Increment.

2. In the *Enter The Nudge Increment Distance* screen, enter the distance the Run screen **Nudge** buttons move the line back to the correct path, and then tap **OK**.
3. Select *End of Row Warning Dist*.
4. In the Enter *End of Row Warning Distance* screen, enter the distance for the end-of-row warning.

***Note** – Longer vehicles that may take longer to turn require an earlier warning, which dictates a greater distance.*

5. In the *Autosense* list, select either On, or Off.

   Most recent Autopilot systems use an AutoSense™ device that require this setting be set to On.

   Older Autopilot system installations that use the electrical system to measure the vehicle status, select the appropriate connections under Step 7: *Legacy Sensors*.

6. In the *Valve On* speed list, select either Normal, Low, or Ultra Low.

   Under normal operating speeds this should be set to Normal. For vehicles operating at very slow speeds, this should be set to Low or Ultra Low.

   Display speed thresholds:

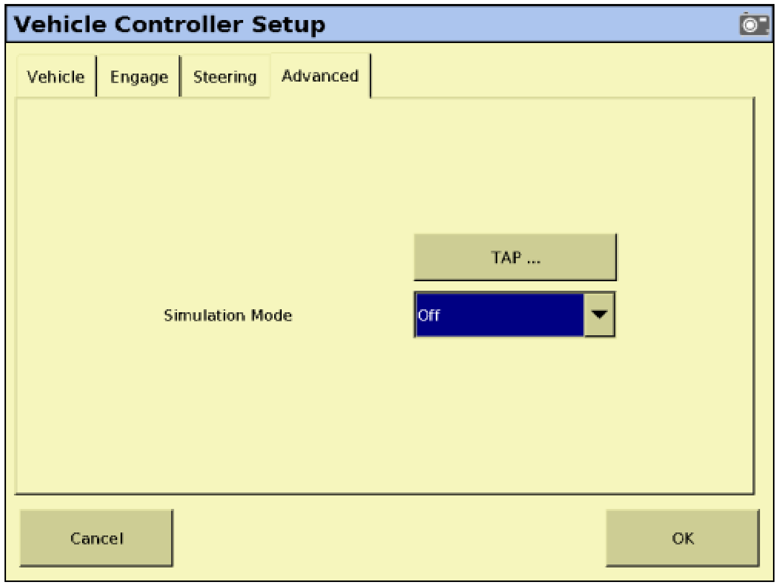
Setting	Speed threshold
Normal	> 0.4 m/s (1.3 ft/s)
Low	>0.1 m/s (0.3 ft/s)
Ultra Low	> 0.02 m/s (0.07 ft/s)

***Note** – The Autopilot NavController II must have firmware version 5.10 or later to support the Low and Ultra Low settings.*

7. In the *Legacy Sensors* list, select either None, Wheel Speed Only, Gear Lever Only, or Wheel and Gear.

***Note** – The Legacy Sensors list is only available when the Autosense setting is set to Off.*

Configuring the Advanced tab

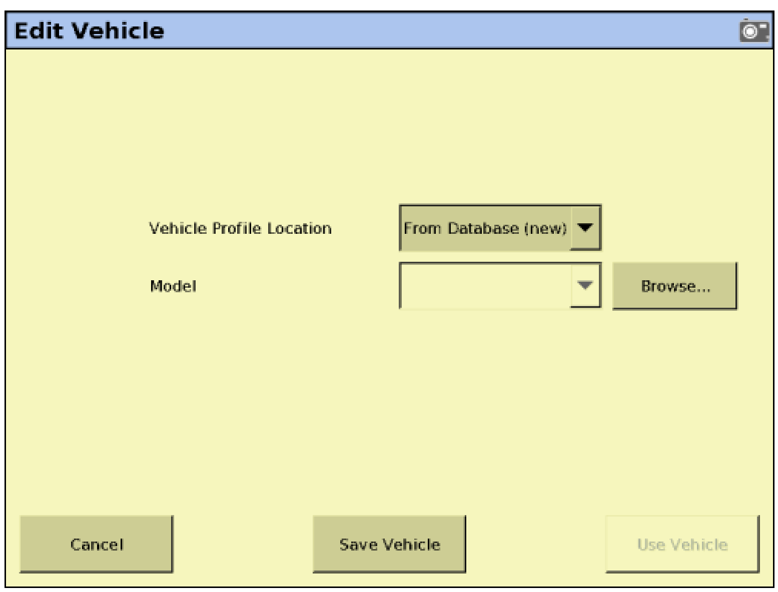


***Note –** For more information on how to utilize the features in the Advanced tab, contact Trimble Support.*

Tap **OK**. The Autopilot controller is now configured.

Selecting the vehicle

1. In the *Vehicle* tab on the *Vehicle Controller Setup* screen, tap **Edit**:



There are a number of pre-configured profiles for the various vehicle makes and models. You can load them from:

– Autopilot controller. The majority of vehicle profiles are stored on the Autopilot controller.

– Vehicle profile database file. As additional profiles become available or are updated, they are added to a vehicle profile database. You can download the database and load profiles from it.

– Saved file. You can install an individual vehicle profile that you have previously saved.

2. In the *Vehicle Profile Location* group, select the source for the make and model.

Tap this button…	See…	Then go to step…
From Controller (new)	Selecting a new vehicle make and model from the list on the Autopilot controller.	3
From Database (new)	Selecting a new vehicle make and model from a database of vehicles (.vdb) on the FM-1000 integrated display. If you need to obtain a .vdb file, contact your local reseller.	4
From Saved File (existing)	Selecting a saved vehicle make and model from the display (.cfg) on the card.	5

Selecting a new vehicle make and model from the list on the Autopilot controller

a. From the drop-down list, select *From Controller (New)*.

b. Tap the *Model* drop-down box and then select the make and model that you require from the list.

Selecting a new vehicle make and model from a database

a. From the drop-down list, select *From Database (new)* and then tap **Browse**.

b. Select the .vdb file that you want to open and then tap **OK**.

Selecting a saved vehicle make and model from the display

a. From the drop-down list, select *From Saved File (existing)* and then tap **Browse**.

b. Select the required file and then tap **OK**.

c. Select *Change Vehicle* to save the new settings. The following message appears:

The specified vehicle model will now be selected on the Autopilot controller. This will cause the Autopilot controller to be reset. Do you want to continue?

Note – *If you select a vehicle make and model but do not upload that configuration to the Autopilot controller, that make and model will not be loaded.*

3. Tap **OK** to load the new configuration.

The following message appears:

The Autopilot controller will now be reinitialized in order to complete the vehicle selection.

4. Tap **OK**.

   The file is now loaded.

For more information on saving vehicle profiles on the FM-1000 integrated display, see Saving a vehicle profile, page 147.

Autopilot calibration

Once you configure the vehicle make and model, calibrate the system for your individual vehicle.

The Autopilot system calibration process records additional details about your vehicle, which helps the system to steer the vehicle more accurately. For high accuracy systems, you must have all the settings correct.

The vehicle calibration screen tools are similar to those in the Autopilot Toolbox II software.

Notes on calibration

- Before you perform vehicle calibration, select the vehicle make and model on the *Vehicle Setup* screen. See Selecting the vehicle, page 123.
- No calibration is required if the system is installed on a Cat MT 700/800 series equipped with the ISO option.

Common calibration items

You can calibrate several aspects of the vehicle. The calibrations that are available depend on which components are installed in the vehicle and system.

Four calibration options appear for all types of vehicle.

***Note –** You must perform the Controller Orientation and the Roll Correction calibrations.*

Option	Description
Controller Orientation	Correctly associate the outputs of the Autopilot controller sensors with the direction of the vehicle.
Manual Override	Required for platforms that employ a pressure transducer for the manual override function. Change the default only if the operation of the manual override function is unacceptable.
Roll/Antenna Compensation	Compensates for antenna height and static roll caused by minor variations in the Autopilot controller and the GPS receiver mounting.
Line Acquisition	How aggressively the vehicle approaches the guidance line.

For articulated and front-wheel steered vehicles, three additional calibration options appear:

***Note –** The steering sensor and automated steering dead zone procedures are **required**. The steering sensor calibration must be performed first.*

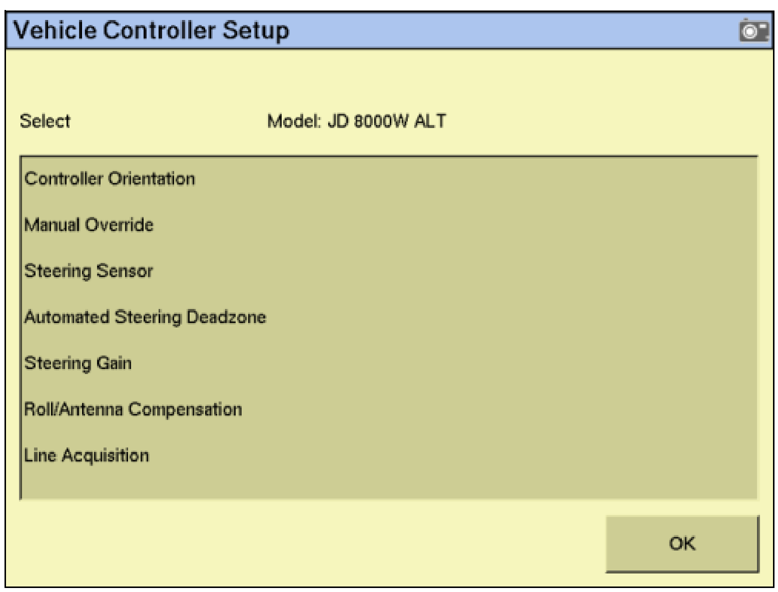
Option	Description
Steering Sensor	Converts the sensor output into commands for steering full left, full right, and any position in between.
Automated Steering Deadzone	Required to learn the vehicle's steering dead zones.
Steering Gain (proportional steering gain)	Required only if system steering performance is unsatisfactory.

The ***steering deadzone*** is the amount of pressure that the system must apply to the hydraulics before the wheels begin to turn.

To configure this vehicle type...	See...
Hydraulically-steered tracked tractors	Page 145
Tracked tractor	Page 145

Calibrating the Autopilot option

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the Autopilot option and then tap **Calibrate**:



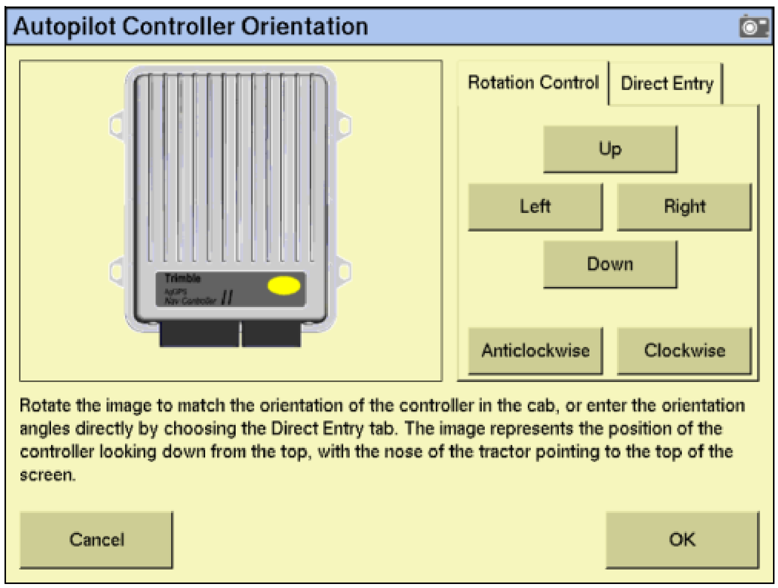
4. Select an item to configure and then tap **OK**.

5. Configure the selected item.

To configure...	See page...
Controller orientation	page 127
Manual override	page 128
Steering sensor	page 130
Automated steering deadzone	page 134
Steering gain	page 136
Roll/antenna correction	page 141
Line acquisition	page 144

Configuring the controller orientation

1. Select the *Controller Orientation* option from the list:



An image represents the current mounting orientation of the controller.

The image is shown as though:

– You are looking down on the vehicle from above.

– The top of the screen points to the nose of the vehicle.

2. Use the buttons to select the orientation of the controller.

If the controller is set at a sloped angle, the vehicle profile will set the NavController orientation.

***Note** – Install the NavController as described in the vehicle install instructions. If custom angles are used, the on-screen image of the controller does not appear.*

3. Tap **OK** to accept the new orientation or tap **Cancel** to exit.

Configuring the manual override sensitivity

Manual Override sensitivity calibration is valid only for platforms that employ a pressure transducer for the manual override function. The software automatically detects whether or not the vehicle configuration includes this type of sensor and provides this option if required.

One way to disengage the Autopilot system is to turn the steering wheel. This is called the ***Manual Override***.

When you turn the steering wheel, there is a voltage spike that then tapers off. This spike and decline occurs at different levels for different models of tractor.

The manual override sensitivity is the level that the voltage must spike to before the override occurs and the system disengages. The voltage must also taper below that level before automated steering can be engaged again.

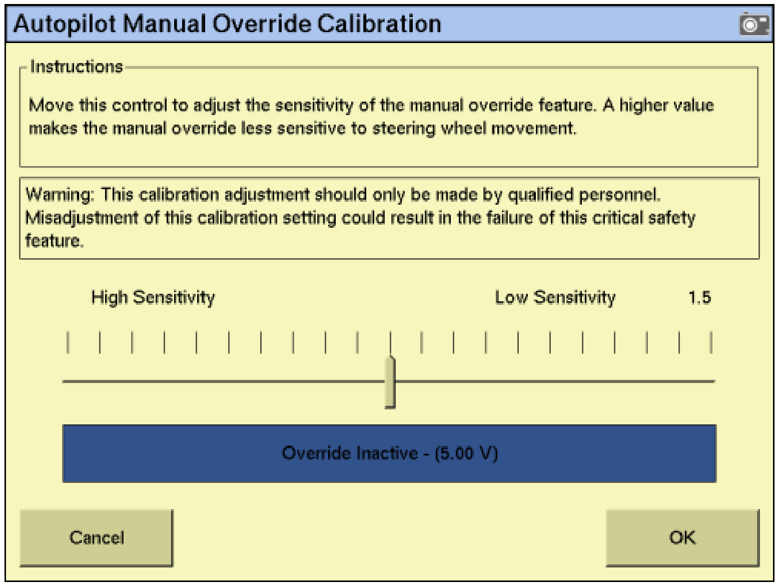
- If you set a high level of sensitivity, the system will disengage more quickly and you will have to wait longer before you can re-engage.
- If you set a low level of sensitivity, the system will take longer to disengage and you will be able to re-engage more quickly.

WARNING – Incorrect adjustment of the Manual Override Sensitivity calibration setting could cause this critical safety feature to fail, resulting in personal injury or damage to the vehicle. Any adjustment to this setting must be made only by an authorized dealer.

Trimble strongly recommends that you perform this calibration only if the default sensitivity is unacceptable under all conditions. ***Do not to choose a sensitivity setting that is either too sensitive or not sensitive enough***. In either case, manual override may cease to function correctly. On some platforms, you could set the sensitivity so low that the manual override function will not detect any steering wheel motion. It is vital that you avoid this.

To configure and check the manual override:

1. Select the *Manual Override* option from the procedure list. (See page 125).



2. Test the current manual override setting:

a. Turn the steering wheel. The **Override Inactive** button changes color when the Override becomes active. With the system active, assess whether the manual override feature is at an acceptable level of sensitivity for:

– Speed of steering wheel turn

– Distance of steering wheel turn

b. To adjust the manual override sensitivity setting, select the slider bar. Move the slider bar as follows:

Slider bar direction	Result	Triggers manual override...
Left	Increased sensitivity	more easily
Right	Decreased sensitivity	less easily

The value to the right of the slider shows the current setting. The total range is 0.5 to 2.5 (where 0.5 is the most sensitive setting and 2.5 is the least sensitive).

c. To try the new setting, tap **OK**. The *Vehicle Calibration* screen appears.

d. Select Manual Override again. The *Autopilot Manual Override Calibration* screen appears again.

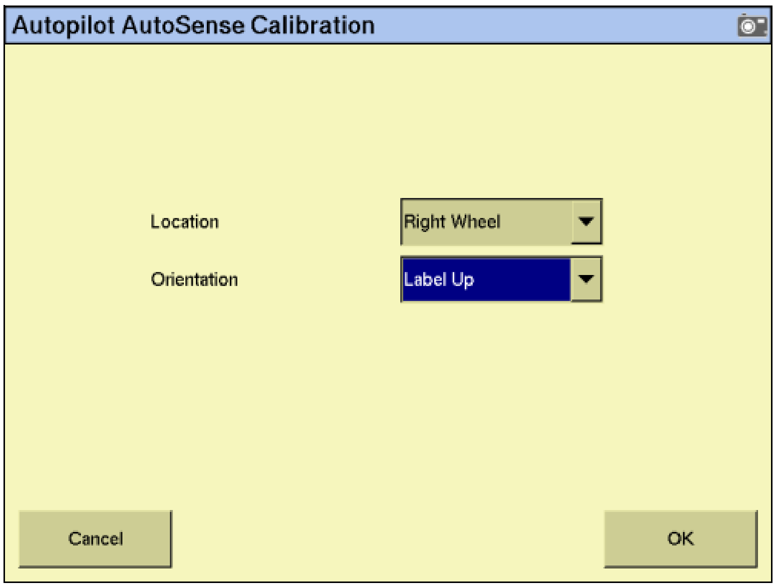
e. Repeat Steps b, c, and d to test each new setting.

Tip – You can also evaluate the performance of the manual override feature under conditions of loading and/or activities which may affect the pressure of the hydraulic system. For example, you can turn on the auxiliary hydraulics while you evaluate the manual override sensitivity.

f. Tap **OK** to accept the new setting or tap **Cancel** to exit.

Calibrating the AutoSense device

1. Select Autosense Calibration from the list on the Vehicle Controller Setup screen:



2. From the *Location* drop-down list, select the AutoSense position.
3. From the *Orientation* drop-down list, select the AutoSense orientation.
4. Tap **OK** to confirm selections.

Calibrating the steering angle sensor

Perform steering sensor calibration to convert the voltage output of the steering sensor into an equivalent steering angle measurement.

Note *– Complete this calibration **before** you attempt to calibrate the steering deadzone or roll correction procedures.*

Note *– Perform the steering sensor calibration only if a rotary potentiometer is installed on the vehicle. If an AutoSense device is selected as the steering angle sensor, the Steering Sensor screen does not appear.*

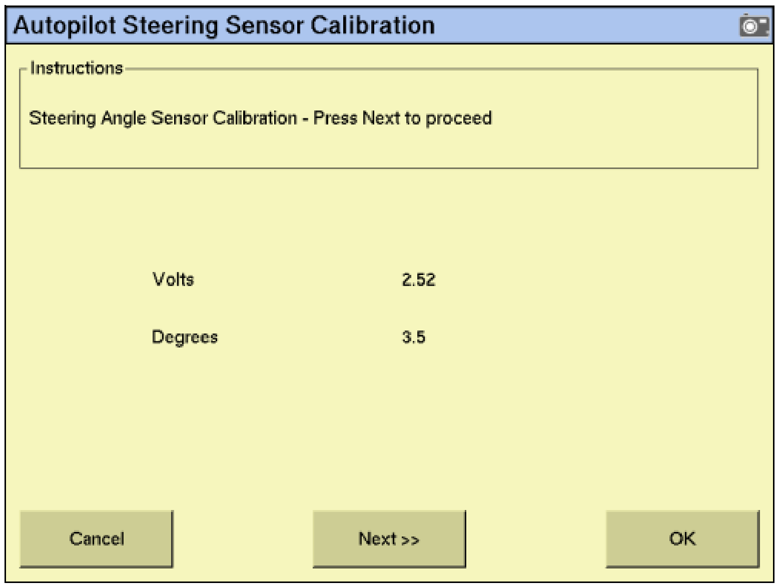
This calibration requires the vehicle to be in motion. Ensure that you:

- Perform this procedure on a hard, level surface that is free of obstructions.

- Follow the instructions on each page.
- Maintain a tractor speed above 1.6 kph (1 mph).
- Watch the *Sensor Angle* field for a symmetrical angle reading at the steering extremes while you manually steer the wheels to full right and full left.
- Watch the *Sensor Angle* field to ensure that the angle reading is near zero while you manually steer the wheels straight ahead.

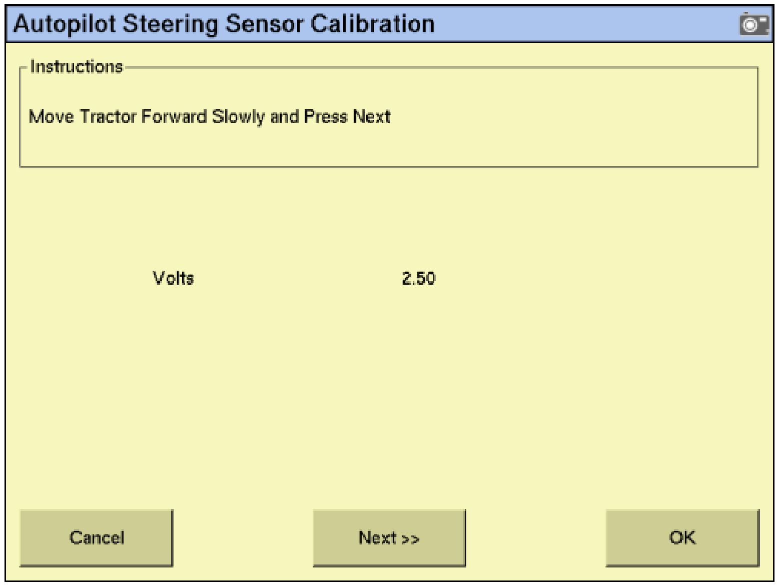
To run the steering sensor calibration:

1. Select the *Steering Angle* procedure from the calibration list. See Autopilot calibration, page 125:



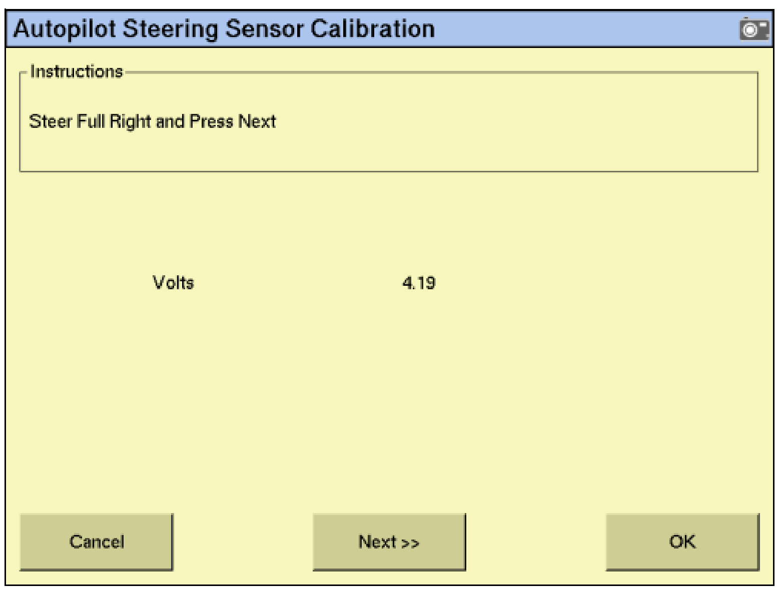
2. Move the tractor forward slowly.

3. Center the steering wheel and then tap **Next**:



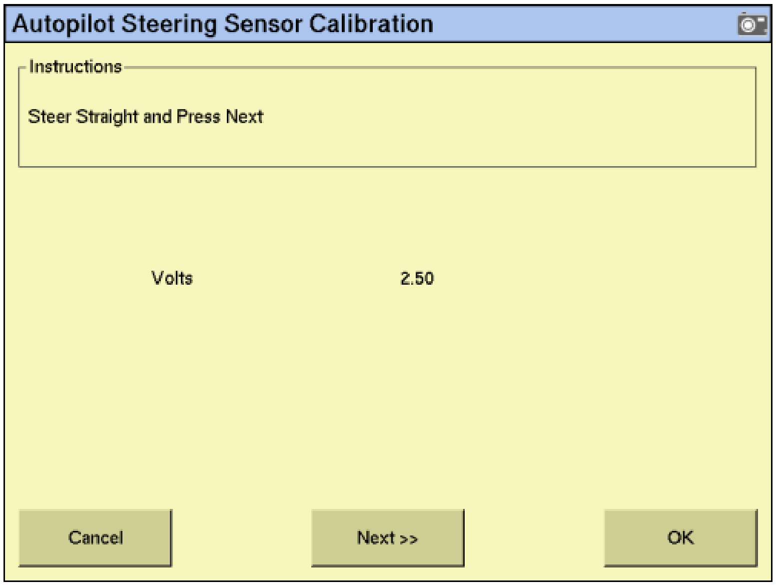
4. Turn the steering wheel completely to the left and then tap **Next**. If the steering wheel is not turned completely to the left or if the steering sensor requires adjustment or replacement, an error message appears.

   The value in the *Volts* field is updated as you turn the steering wheel:



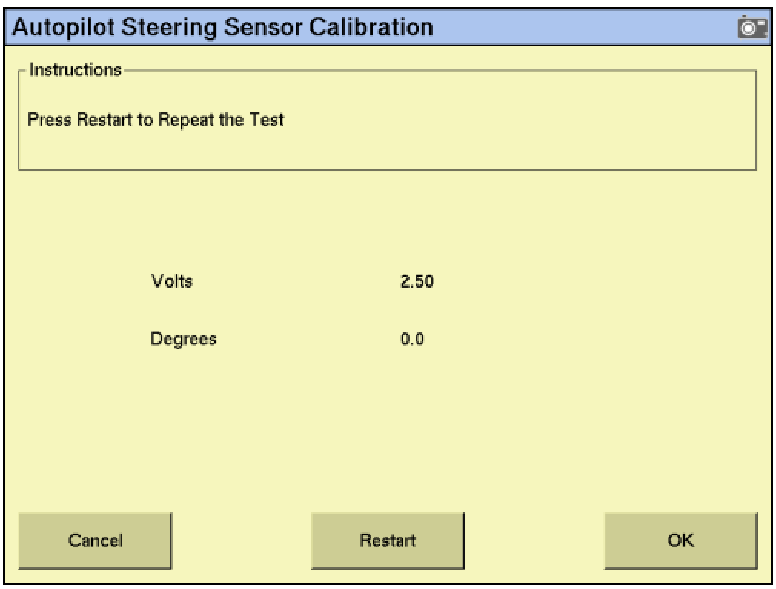
5. Turn the steering wheel completely to the right and then tap **Next**. If the steering wheel is not turned to the full right position or if the steering sensor requires adjustment or replacement, an error message appears.

The following screen appears:



6. Center the steering wheel. While the wheel is at the center position, tap **Next**.

   The value in the *Volts* field is updated as you turn the steering wheel:



7. Tap **OK** to accept the calibration.

Calibrating the automated steering deadzone

The Automated Deadzone calibration procedure runs a series of tests on the valve and steering hydraulics to determine the point at which steering movement occurs.

WARNING – During the Automated Deadzone calibration, the system moves the wheels that steer the vehicle. To avoid injury, be prepared for sudden vehicle movement.

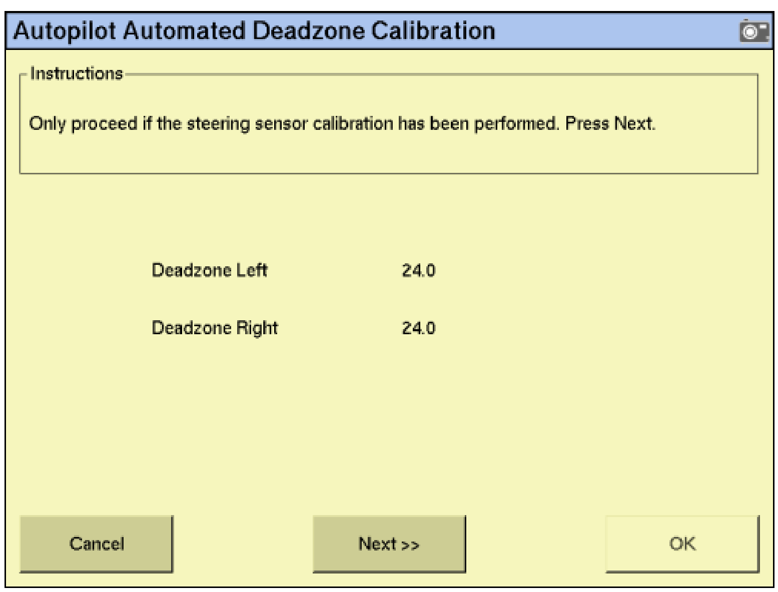
In this test, the system independently opens and closes each side of the steering system while determining the point at which wheel movement occurs.

Notes on calibrating the automated steering dead zone

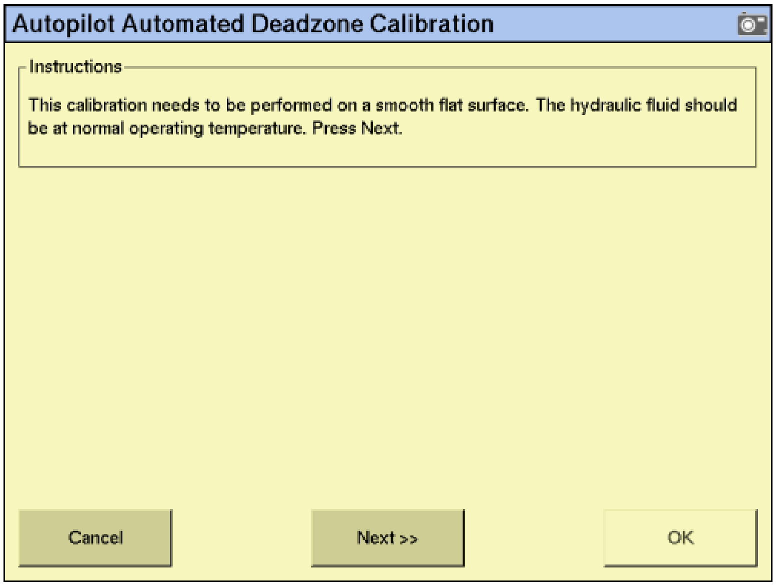
- You must complete the Steering Angle procedure before you run this procedure.
- To ensure optimal system performance, the hydraulic fluid must be at normal operating temperature when you run this procedure. On some vehicles with large reservoirs, it may take several hours for the fluid to reach operating level, especially if the implement circuit is lightly loaded. Consult the vehicle documentation to determine if the hydraulic fluid temperature can be shown on a vehicle console.
- If you perform the calibration while the system is still cold, repeat both the Deadzone and the Proportional gain calibration procedures once the system is at operating temperature.

To configure the automated steering deadzone:

1. Place the vehicle in a large field that is free of hazards. To minimize the effect of the ground conditions, the field should have smooth soil that is loose but firm.
2. Select the Automated Steering Deadzone procedure from the calibration list. See page 126.



3. Tap **Next**:



4. Tap **Next** in the two screens that appear next.
5. Follow all instructions. Tap the **Test Right** and **Test Left** buttons to perform the Deadzone calibration.

   As ground conditions affect the results of this calibration, Trimble recommends that you perform the calibration at least three times, or until the average deadzone values change by less than about 0.5.

   To minimize the total amount of space needed for the complete calibration, you can reposition the vehicle between the phases of the test. If the available flat, smooth space is extremely limited, re-align the vehicle after each segment of the calibration.

To reposition the vehicle:

1. Wait until the software prompts you that the next phase is ready to begin.
2. Look at the screen to determine whether the next phase will require a left or right turn.
3. Reposition the vehicle so that the turn will use the space that you have available.
4. Tap the button to begin the next phase.

CAUTION – Obstacles in the field can cause collisions, which may injure you and damage the vehicle. If an obstacle in the field makes it unsafe to continue a particular phase of the Automated Deadzone calibration, stop the vehicle to abort the phase and turn the steering wheel to disengage the system. Reposition the vehicle and continue from the current test phase.

Automated Deadzone error messages

If a calibration cycle is unable to complete successfully, one of the following error messages appears:

Message	Meaning
Error - Manual Override Detected	Manual override was detected before the calibration cycle could be completed. Retry.
Error - Vehicle Moving Too Slow	The vehicle was moving too slowly for the calibration cycle to successfully finish. Make sure the vehicle is moving at least 0.8 kph (0.5 mph) during each calibration cycle.
Error - Steering Close To End Stops	Before the calibration cycle could be completed, the measured steering angle approached the end stops. Retry, and if the problem persists, instead of centering the steering at the start of each cycle, try turning the steering in the opposite direction to that which is being tested so that the calibration procedure has a greater range to test over.
Error - Valve Connectors Could Be Swapped	The calibration test sensed the steering turning in the opposite direction to what was expected. Retry, and if the problem persists either the valve connectors have been accidentally swapped or the steering sensor calibration was performed incorrectly.
Error - No GPS	A GPS receiver must be connected and outputting positions before the software can run the calibration procedure.
Error - No Steering Response Detected	During the calibration cycle, insufficient movement was sensed for the calibration to complete. If the problem persists, the hydraulic installation could be faulty.
Error - Unable To Determine DZ: Try Again	A problem occurred when trying to compute dead zone. Retry, and if the problem persists, contact Technical Support.
Error - Software Problem Detected	The software was unable to complete the calibration due to insufficient movement of the vehicle. If the problem persists, contact Technical Support.

Calibrating the proportional steering gain

Note – *Complete the steering sensor calibration* ***before*** *you perform the proportional gain calibration. Perform the proportional steering gain calibration* ***only*** *when the Autopilot system performance is less than satisfactory.*

The proportional steering gain (PGain) setting enables you to reach a compromise between rapid steering response and stability. Modifications to the PGain setting affect two steering characteristics:

- *Slew Time*: The amount of time that the front wheels take to move from the far left to the far right position and vice versa.
- *Overshoot*: The percentage by which the front wheels exceed the commanded angle before they settle on the correct value.

To correct slight variations caused by valve current response, friction, and hydraulic fluid viscosity, alter these settings.

High PGain values...	Low PGain values...
Decrease the slew time and increase the overshoot. This provides rapid responses, but can cause the steering to exhibit signs of instability (for example, a tendency to excessively overshoot).	Increase the slew time and decrease the overshoot. This improves the stability but can introduce significant delays in the steering response and can cause the vehicle to oscillate from side to side.

Notes on performing the proportional steering gain calibration

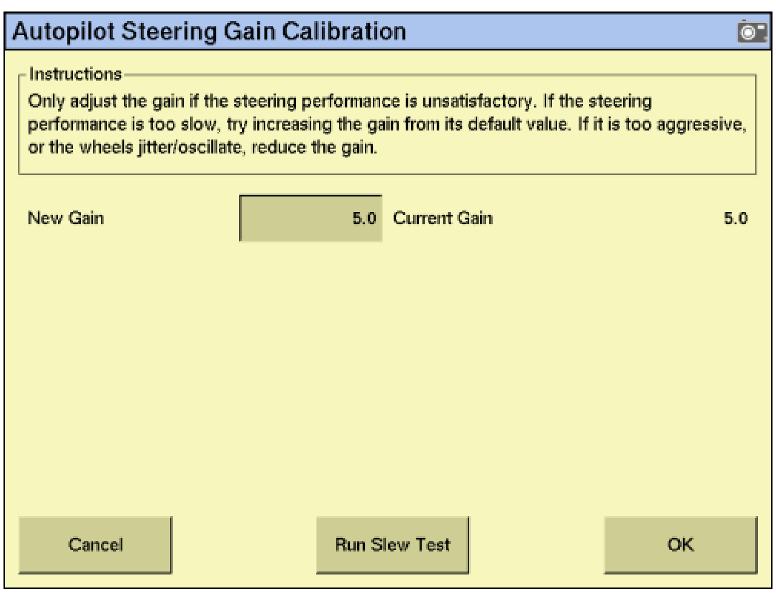
- Perform the Automatic Deadzone calibration immediately before you run the PGain calibration, even if the Automatic Deadzone calibration has been performed in the past.
- Perform this calibration on a hard, level surface that is free of obstructions.
- Maintain a vehicle speed above 1.6 kph (1 mph) while you perform the calibration.

Increase the proportional gain up to the point just before any one of the following occurs:

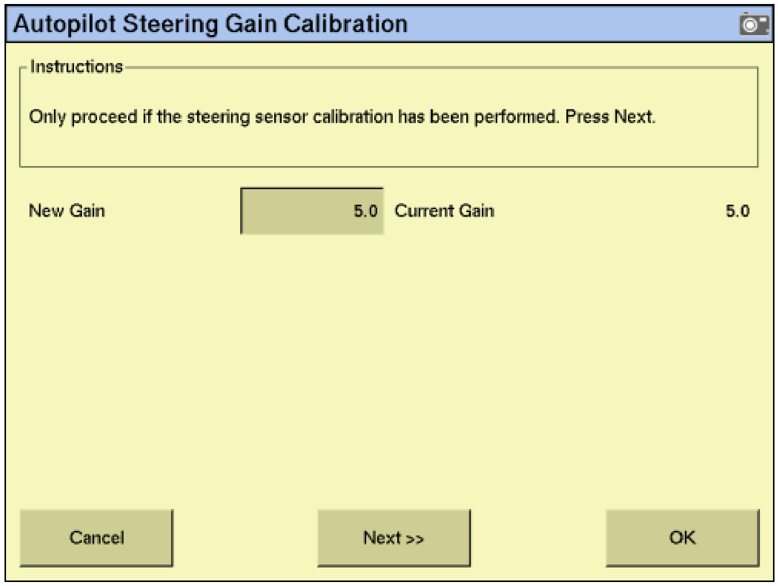
- Slew times no longer decrease (a low value is required)
- Overshoot exceeds 5 – 8% (depending on the vehicle)
- Wheels noticeably shake near end stops

To calibrate the proportional steering gain:

1. Select the Valve P-gain procedure from the calibration list. See Autopilot calibration, page 125. The first *Autopilot Steering Gain Calibration* screen appears:



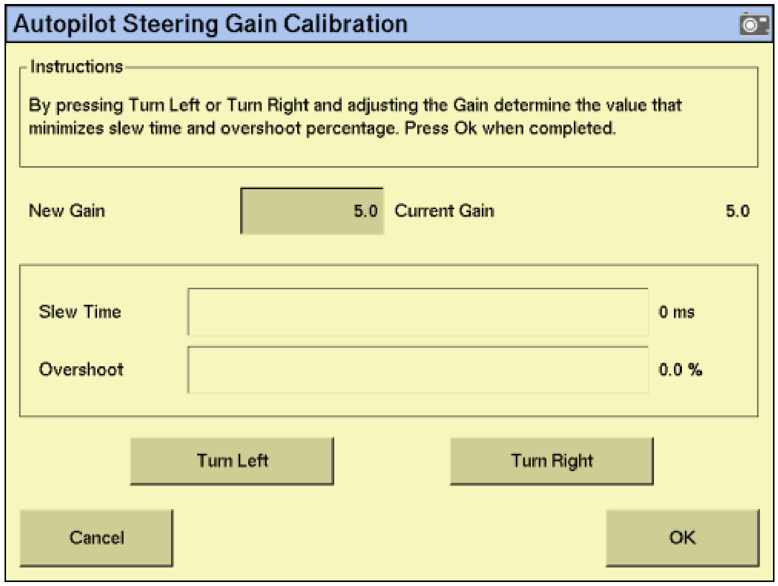
2. Tap **Run Slew Test**. A warning message appears.
3. Tap **Next**:



CAUTION – The wheels can move abruptly during the Proportional Steering Gain procedure while the Autopilot system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury to occupants of the vehicle. Be prepared for sudden wheel movements.

4. Tap **Next** in the two screens that appear next.
5. Test various gain settings while you monitor the vehicle performance and the values in the *Slew Time* and *Overshoot* fields for the Turn Left phase.
   a. Adjust the *New Gain* field (if required).
   b. Turn the front wheels completely to the right to begin the test. (The test is for the stop-to-stop position.)

c. Tap **Turn Left**. Both turn buttons are unavailable while the wheels slew:



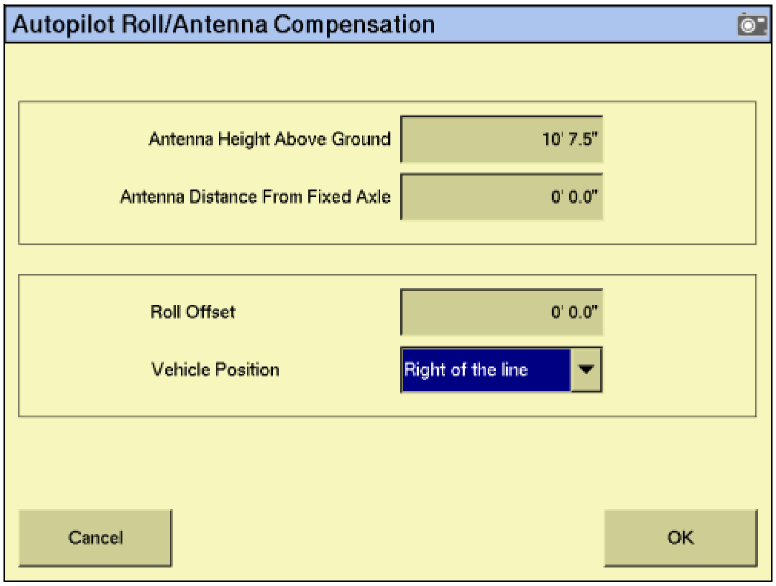
***Note –** The optimum gain setting has short slew time (short millisecond reading) and low overshoot percentage (less than 5–8%).*

6. Repeat Step 5 with **Turn Right**. Both turn buttons are unavailable while the wheels slew.
7. When you locate the best gain value, do one of the following:
   - Tap **OK** to save the value in the Autopilot controller memory.
   - Tap **Cancel** to restart the calibration procedure.

Configuring the antenna position and roll offset correction

***Note** – Antenna offsets are provided when the antenna cannot be placed directly over the working point of the implement. Trimble recommends that these offsets should be minimized whenever possible.*

1. Select *Roll/Antenna Correction* from the calibration list. See page 125.



2. Before changing these settings, complete the following procedures.

Notes on configuring the antenna position

- Before configuring the antenna compensation, make sure that:
  - the Autopilot system is completely set up
  - the Autopilot software is properly configured
  - the correct GPS corrections are enabled
  - you read this section carefully
- If multiple GPS technologies will be used (for example, RTK and SBAS), use the technology with the highest accuracy when you perform the Roll Correction calibration.

1. Setting the antenna height above the ground

1. Place the tractor on a flat, level surface.
2. Measure the distance from the ground to the base of the GPS receiver (or antenna).
3. Enter this value in the *Antenna Height Above Ground* field.

2. Setting the antenna distance from the fixed axle

1. Place the tractor on a flat, level surface.
2. Measure the distance from the fixed axle to the center of the GPS receiver (or antenna).
3. Enter this value into the *Antenna Distance from Fixed Axle* field. Enter a negative value if the GPS receiver antenna is to the rear of the fixed axle. The nose of the vehicle is considered the forward direction.

3. Configuring the roll offset correction

Use one of the following methods to calculate the roll offset and then enter the roll offset correction to compensate for it:

- Tire track offset method
- Flag offset method

Choose the method which best matches the conditions.

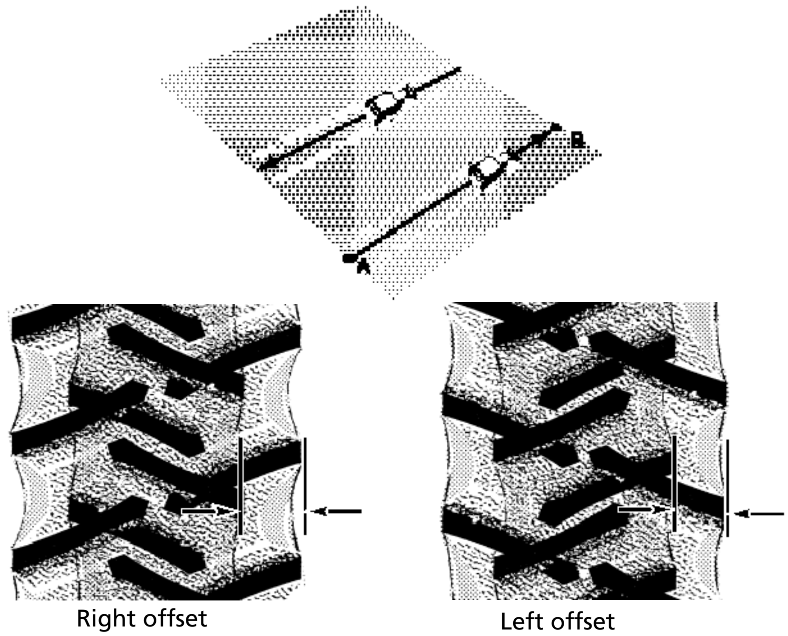
Calculating the roll offset: Tire track offset method

Tip – Use a highly repeatable GPS correction mode for roll correction. For best results, use a RTK mode or OmniSTAR HP signal that has been converged for at least twenty minutes. If you do a roll calibration with less accurate GPS correction modes, repeat the measurements ***at least four times*** to ensure a more consistent result.

1. Remove any implement from the vehicle.
2. Drive the tractor to a relatively flat field where tire impressions are visible and where you can complete passes of at least 400 m (1320 ft) in length.
3. Reset the roll offset value to 0 (zero).
4. Create an AB Line.
5. Create a clean set of tire tracks in the field. To do this, start a new pass away from the area where the AB Line was created. When the system is stable, engage automatic steering mode and allow the Autopilot system to complete the pass.
6. At the end of the pass, turn the tractor around to return along the same pass from the opposite direction.
7. Engage automated steering mode and allow the system to complete the pass.
8. In the middle of the return pass, stop the tractor and confirm that the current position is directly on the AB Line. This ensures there is no cross track error.
9. Park the tractor and exit the cab. Evaluate the tire track pattern between the first and return paths.
10. Measure the difference between the track passes and record the distance. Also note whether the return pass is to the left or the right of the original pass. Record the results in Table on page 144.

***Note –** The offset should be consistently to the left or right.*

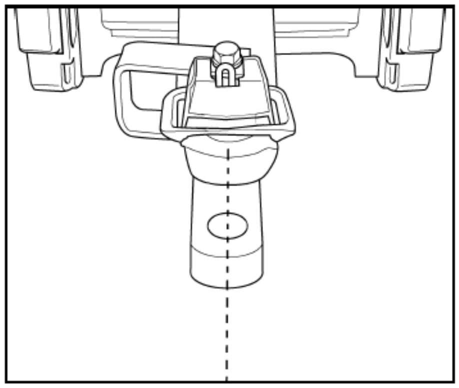
11. Repeat Step 5 through Step 10 two more times, for a total of three test runs. Use Table on page 144 to record the offset distance and the left or right direction of offset for each test run.



Calculating the roll offset: Flag offset method

1. Remove any implement from the vehicle. The vehicle draw-bar must be centered.
2. Drive the vehicle to a relatively flat area where you can complete passes that are at least 400 m (1320 ft) in length.
3. Reset the *Roll Offset* value to 0 (zero) on the *Roll Correction* screen. See 3. Configuring the roll offset correction, page 141.
4. Create an AB Line.
5. Start a new pass. Engage automatic steering mode when the system is stable. Stop the tractor midway through the pass. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.

6. Park the vehicle and exit the cab. Use the hitch pin hole in the drawbar as a guide to insert a flag in the ground to mark the vehicle center-line for this pass.



7. Complete the pass. Turn the vehicle around to return along the same pass from the opposite direction.
8. Engage automatic steering mode. Stop the vehicle midway down the pass with the drawbar pin location very close to the marker flag. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
9. Park the vehicle and exit the cab. Use the hitch pin hole in the drawbar as a guide to insert a second flag in the ground to mark the tractor centerline for this pass. Note whether the second pass is to the left or the right of the first pass.
10. Measure the difference between the flags for the two passes and record the distance. Also record whether the return pass is to the left or the right of the original pass. Record the results in the table on page 144.

***Note –** The offset should be consistently to the left or right.*

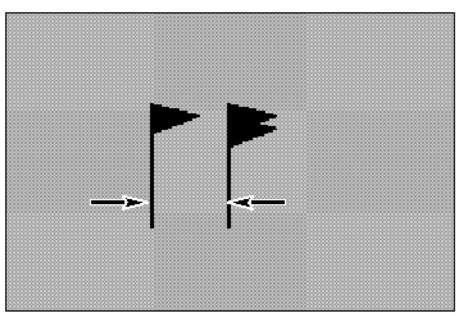


Figure 5.1 Right offset: Measure the distance between the flags

11. Repeat Steps 5 to 10 two more times for a total of three test runs. Use the table page 144 to record the offset distance and the left or right direction of offset for each test run.
12. Average the results of the three runs. (Total the offset distances from the three passes and divide by three).

Table for recording the roll correction results

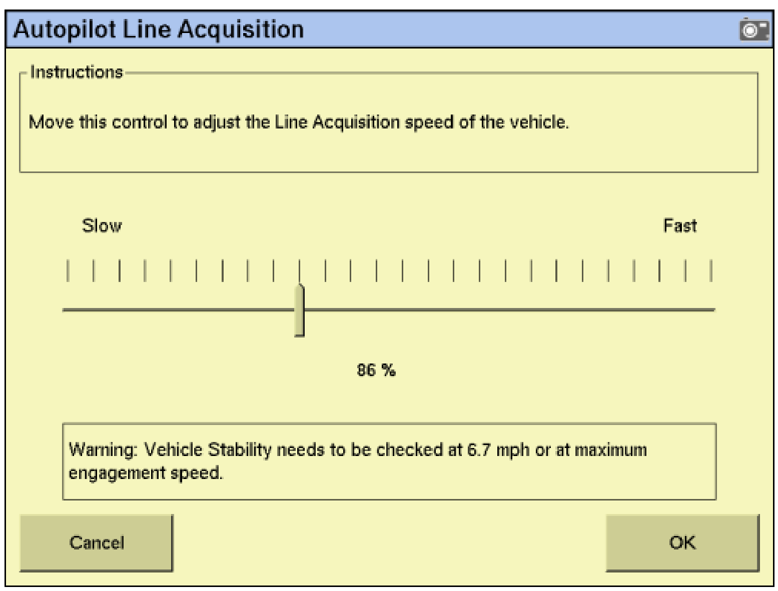
Test run	Offset distance	Offset direction
1		
2		
3		
	Total =	
	Total/3 = (Average offset value)	

Entering the roll offset

1. Enter the average offset value in the *Roll Offset* field. See Configuring the antenna position and roll offset correction, page 140.
2. Select one of the offline direction options, depending on whether the roll offset distance is to the left or right.

Calibrating the line acquisition aggressiveness

1. Select *Line Acquisition* from the calibration list. See page 125.



2. Adjust the line acquisition aggressiveness slider. The slider controls how aggressively the vehicle approaches the guidance line, using a scale from 50% to 150%. The optimal value for each profile is not necessarily 100%: it varies for different vehicle profiles.

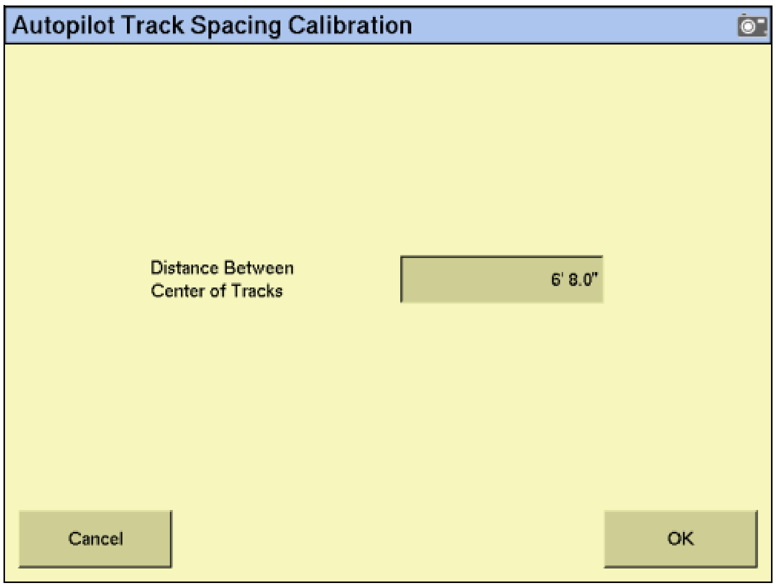
***Note** – When you adjust the slider, check the vehicle stability at the speed shown (4.5 mph in the example above) or at the maximum engage speed.*

Calibrating a tracked tractor

If you selected a tracked tractor as the make and model, the *Track Spacing* option appears on the calibration list. (This option is not shown in the *Vehicle Controller Setup* screen shown on page 126).

Track Spacing value

Use this option to configure the width of the tracks on the vehicle. The width of the vehicle tracks is the distance from halfway across the width of the left track to halfway across the width of the right track:



Calibrating a hydraulically-steered tracked tractor

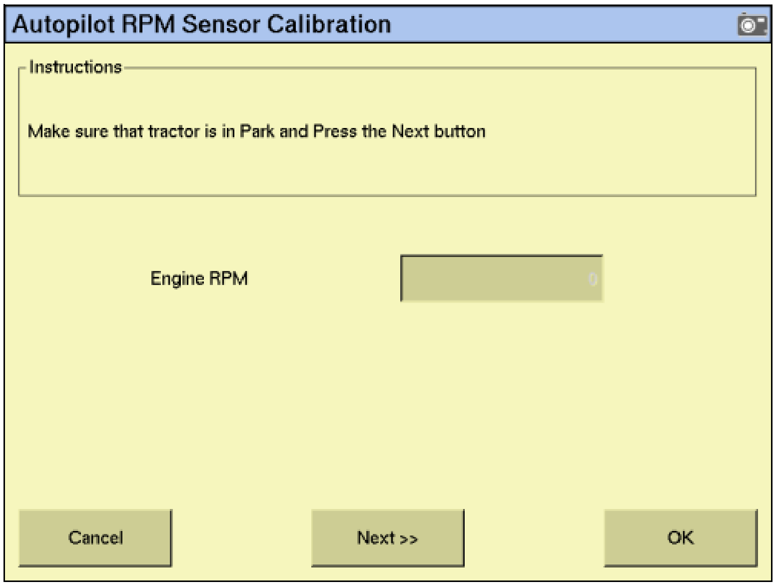
If you selected a hydraulically-steered tracked tractor as the make and model, *Engine Speed* appears on the calibration list.

Notes on hydraulically-steered tracked vehicles

- This group of vehicles includes the CAT/AGCO Challenger Tracked family.
- No calibration is required if the system is installed on a CAT MT 700/800 series equipped with the ISO option.

Autopilot Engine Speed Calibration screen

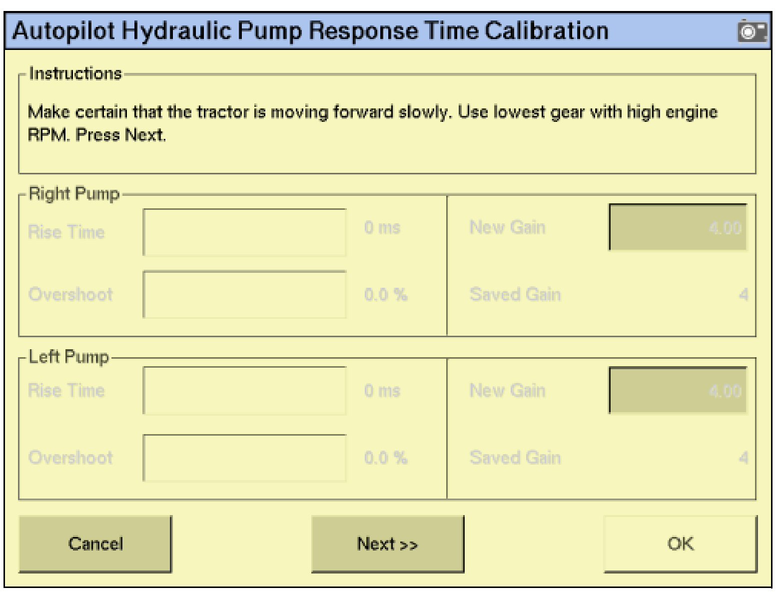
The *Autopilot Engine Speed Calibration* screen enables you to verify that the RPM sensor output is correct:



If the *Engine RPM* value is not close to the actual engine RPM, follow the onscreen instructions to adjust the sensor output.

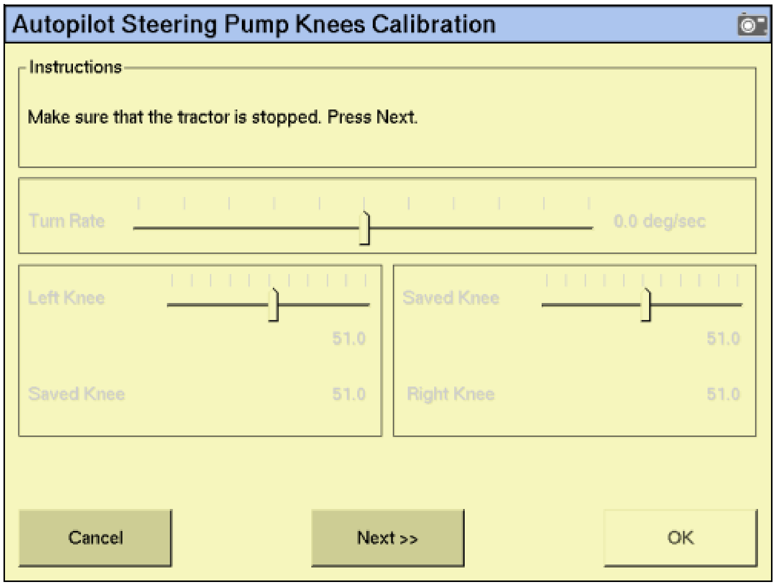
Autopilot Hydraulic Tracked Integral Gain Calibration screen

The *Autopilot Hydraulic Tracked Integral Gain Calibration* screen verifies and optimizes the response of the hydraulic steering pumps. Follow the onscreen instructions to perform this procedure:



Autopilot Hydraulic Tracked Pump Knees Calibration screen

This calibration procedure determines the compensation required for dead-band in the steering pumps:



CAUTION – The vehicle needs to move during the Hydraulic Tracked Pump Knees calibration procedure. To avoid injury, be prepared for vehicle movement.

The instructions for this calibration test span several pages onscreen. Follow the instructions on each page.

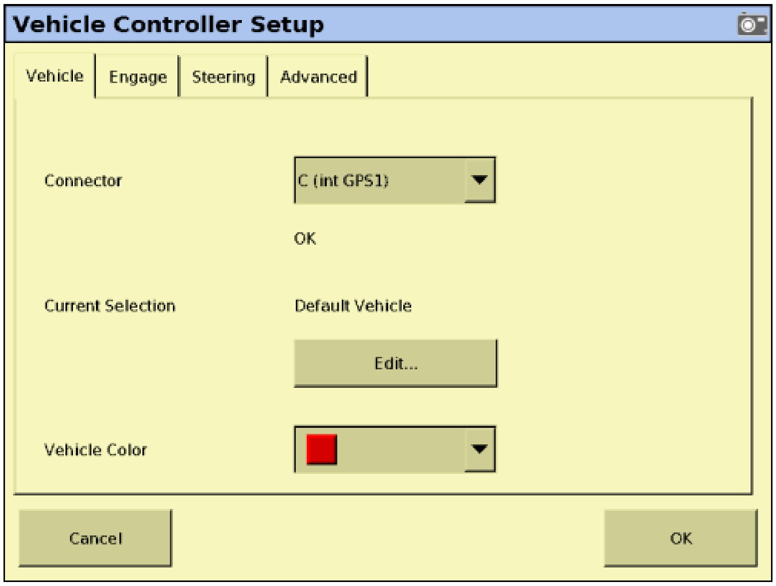
Saving a vehicle profile

***Note** – From firmware version 3.0 on the FM-1000 integrated display, the Vehicle Profile Location defaults to "From Database".*

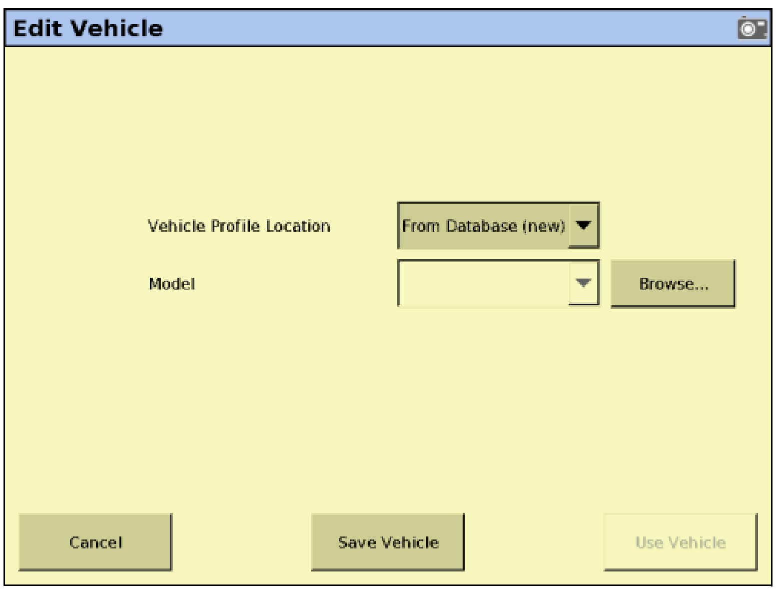
Once you configure and calibrate the Autopilot system for your vehicle, you can save that information for later use. This can be useful if you want to adjust the settings or if you move the display from one vehicle to another.

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.

3. Select the Autopilot option and then tap **Setup**:



4. In the *Vehicle Controller Settings* group, tap **Edit**:



5. Tap **Save Vehicle**.
6. In the *Save Vehicle Configuration* screen, select the *Filename* field.
7. In the *Enter Save Filename* screen, enter a name for the current vehicle profile and tap **OK**.
8. In the *Edit Vehicle* screen, tap **OK**.

Your current vehicle profile is saved.

Configuring the GPS receiver

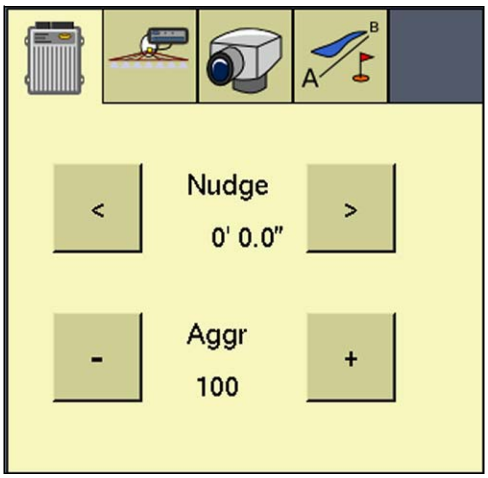
When you install the Autopilot option, the GPS Receiver option is also installed. For instructions on configuring the GPS receiver, see The GPS Receiver, page 165.

Adjusting the Aggressiveness setting

Aggressiveness is the measure of how strongly the system makes steering changes.

- A higher *Aggressiveness* setting brings the vehicle back online faster, but may cause tight oscillations about the line.
- A lower *Aggressiveness* setting is slower to bring the vehicle back online, but can avoid overshoot.

1. From the Run screen, select the *Autopilot* tab:



2. Use the **-** or **+** button to adjust the setting.

***Note** – The default Aggressiveness setting is 100%.*

For a description of the Autopilot **Engage** button, see Engage button, page 51.

Display-only mode

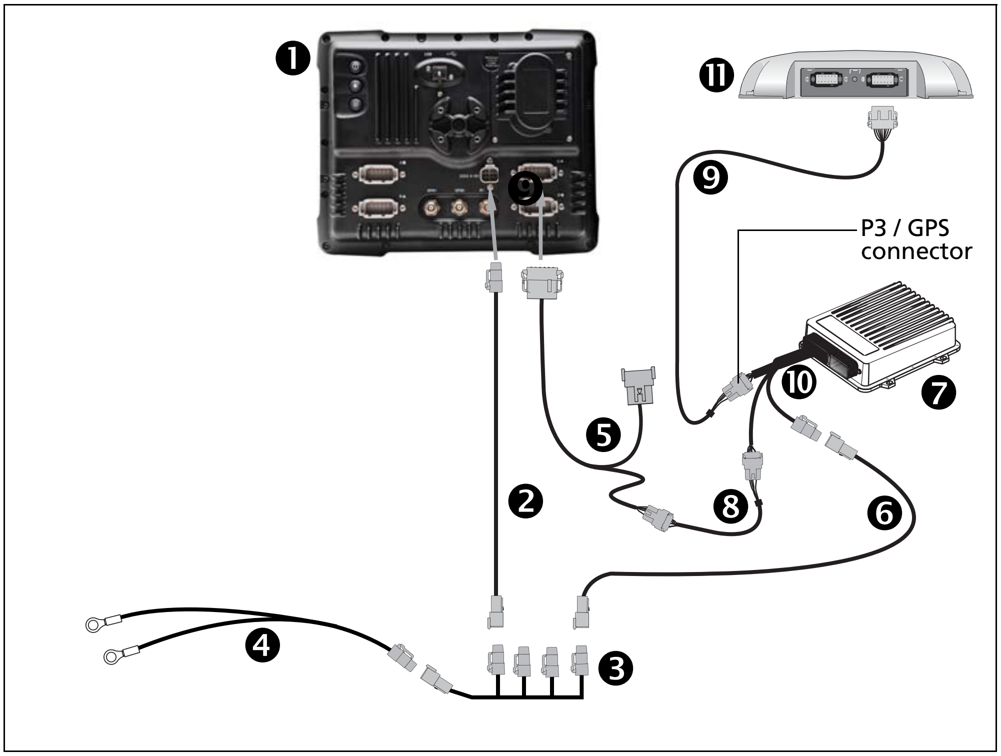
The FM-1000 integrated display can be used as a standalone display for a NavController II that is connected to an external GPS receiver.

When used in this mode, the FM-1000 integrated display's two internal GNSS receivers are not used by the NavController II, but they are still available for other applications.

In this mode, you must use the special adaptor cable (P/N 76442) with the standard FM-1000/FM-1000 to NavController II cable (P/N 75741 or P/N 65522) to connect the display to the P4 display port on the NavController II.

***Note** – You must install the Autopilot option to use the display-only functionality of the FM-1000 integrated display.*

Connecting the FM-1000 integrated display for display-only mode

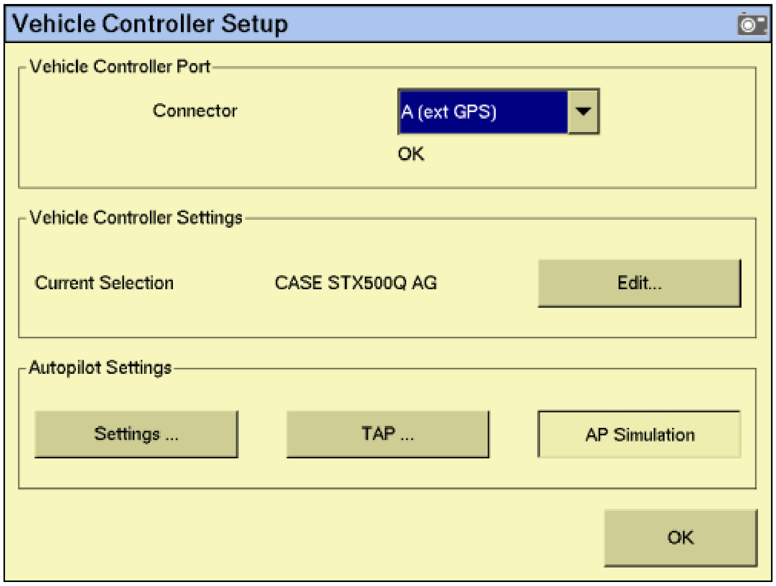


CAUTION – Connecting the Port Replicator on the FM-1000 to NavController II cable ❺ to the P4 or P12 connector of the NavController II harness ❿ will result in damage to the FM-1000 integrated display, and will void the warranty.

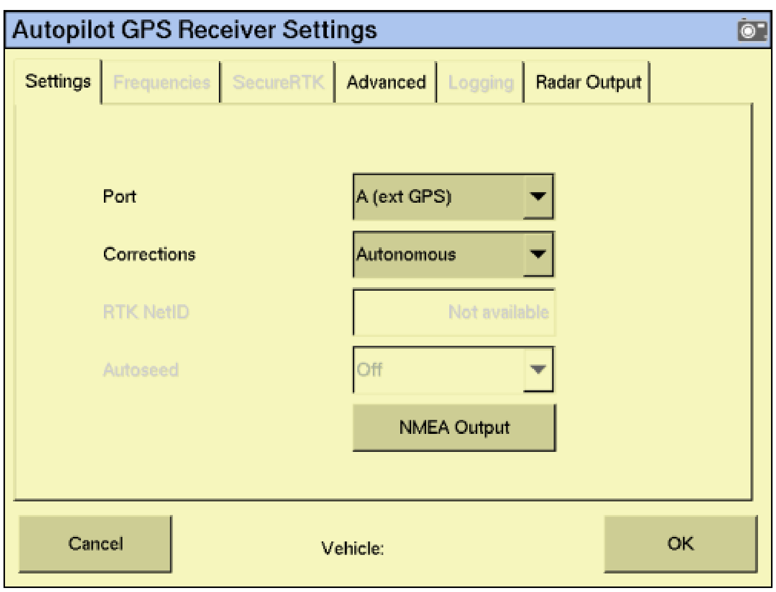
Item	Description	Trimble part number
❶	FM-1000 integrated display	93100-01
❷	FM-1000 power cable	66694
❸	FM-1000 power cable with relay and switch (power bus)	67259
❹	Basic power cable	67258
❺	FM-1000 to NavController II cable with port replicator	75741
❻	2 pin DTM to 2 pin DT power adaptor	67095
❼	NavController II	55563-00
❽	Cable assembly, 8-pin to 12-pin adaptor	76442
❾	Cable, *Ag*GPS 252/252 to NavController II	54608
❿	Main NavController II cable	54601
⓫	*Ag*GPS 252/262 receiver	55500-32

To configure the display-only mode, do the following:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. Select the Autopilot option and then tap **Setup**:



4. From the *Connector* drop-down list, select either *A (ext GPS)* or *B (ext GPS)* and then tap **OK**. The *Configuration* screen appears.
5. Select the Autopilot option's GPS receiver and then tap **Setup**:



6. From the *Corrections* drop-down list, select the required correction option.
7. Tap **OK**.

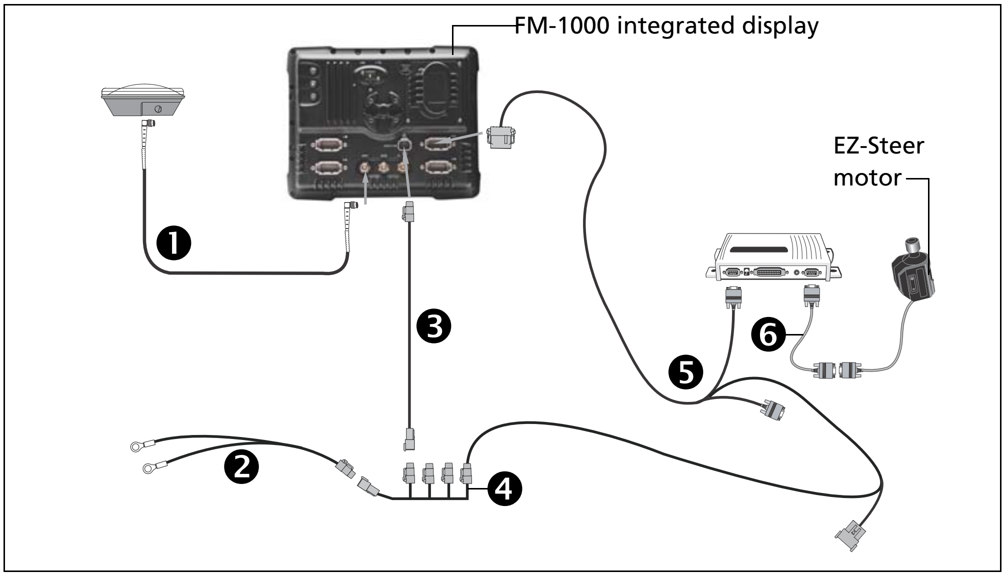
EZ-Steer assisted steering system guidance

The EZ-Steer® assisted steering system works with the FM-1000 integrated display's internal GPS receiver to provide vehicle guidance.

Installing the EZ-Steer controller

For information on installing the EZ-Steer controller in your vehicle, refer to the *EZ-Steer Assisted Steering System Getting Started Guide* and the *EZ-Steer Assisted Steering System Installation Instructions*.

Connecting the EZ-Steer system



Item	Description	Trimble part number
1	Antenna cable	50449
2	FM-1000 basic power cable	67258
3	FM-1000 power cable	66694
4	FM-1000 power bus	67259
5	FM-1000 to EZ-Steer cable	75742
6	EZ-Steer motor cable	62257

1. Use the FM-1000 to EZ-Steer cable to connect the EZ-Steer system to the display.

***Note** – The CAN cable connects to either the C or D port on the rear of the FM-1000 integrated display.*

2. Attach the EZ-Steer controller to the dash. Use the provided bracket.

Calibrating and configuring the EZ-Steer system

The calibration configures the T2™ roll calibration and the EZ-Steer system *Angle per Turn*, *Aggressiveness,* and *Freeplay* settings.

Before you calibrate the vehicle, do the following:

- Ensure that the vehicle's hydraulic oil is up to operating temperature. Refer to the vehicle documentation.
- Ensure that the tire pressure is correct.
- Perform initial calibration without an implement or with the booms folded in on a high-clearance sprayer. After initial calibration is completed, you can fine tune the settings with the implement or booms folded out.
- Choose a field with the smoothest possible surface and perform calibration at the normal operating speed for the vehicle.

The EZ-Steer calibration process requires a straight A–B line. If you do not create an A–B line before you begin the calibration, the system prompts you to open a field and create one.

Calibrating the EZ-Steer system

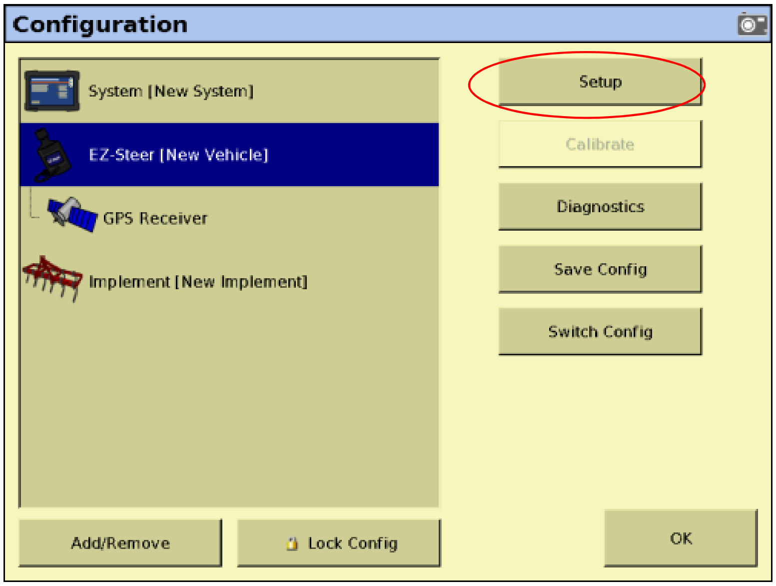
To calibrate the EZ-Steer system to work with the FM-1000 integrated display, you must complete the following:

1. Enter the vehicle settings. See page 154.
2. Calibrate T2 roll compensation. See page 155.
3. Calibrate the EZ-Steer system. See page 158.
   - Angle per Turn
   - Aggressiveness
   - Freeplay offset
4. Confirm the calibration settings.

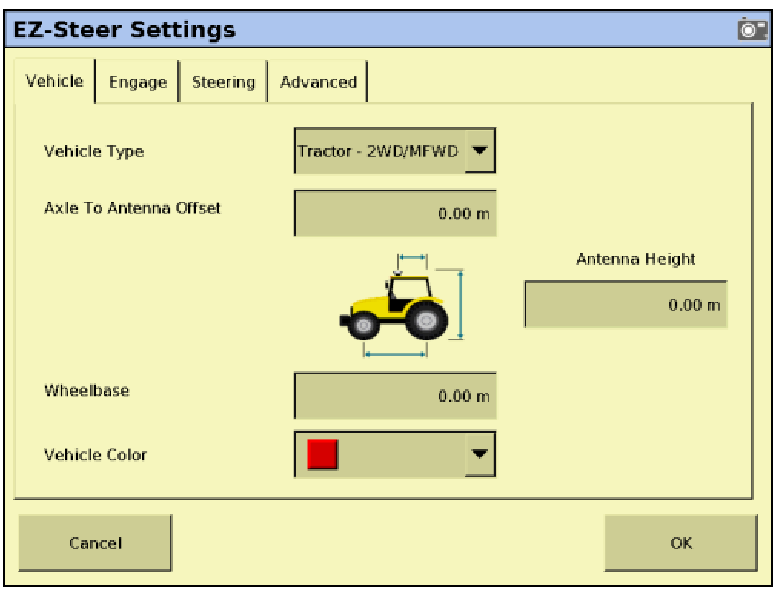
Note – *You may have to perform the EZ-Steer calibration more than once to achieve optimal results.*

Entering vehicle settings

1. Install the EZ-Steer system plugin (for more information, see the *FM-1000 integrated display Plug-ins guide*).
2. From the *Configuration* screen, select the EZ-Steer plugin and then tap **Setup**:



The *EZ-Steer Settings* screen appears:



3. From the *Vehicle Type* drop-down list, select the vehicle type.
4. In the *Axle To Antenna Offset* field, enter the horizontal distance between the axle and the antenna:
   – If the antenna is in front of the axle, enter a *Forward* distance.

– If the antenna is behind the axle enter a *Back* distance.

Note – *Trimble recommends that you measure the offset distance as accurately as possible (within 3"); an incorrect offset may cause poor steering performance.*

5. In the *Antenna Height* field, enter the height of the antenna, measured from the ground to the base of the antenna.

6. In the *Wheelbase* field, enter the wheelbase measurement (horizontal distance between the front and rear axles).

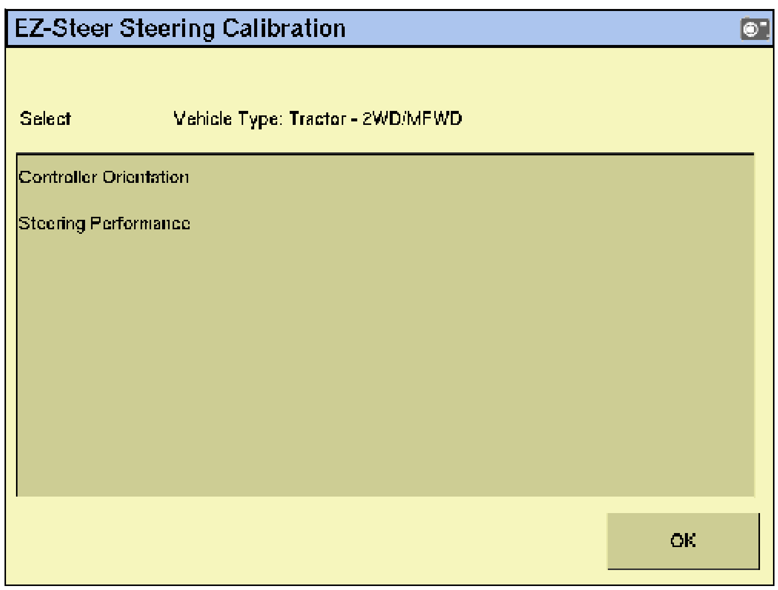
Note – *The Engage, Steering, and Advanced tabs on this screen are populated automatically with starting values, based on the vehicle type selected.*

7. Tap **OK**. The *Configuration* screen appears.

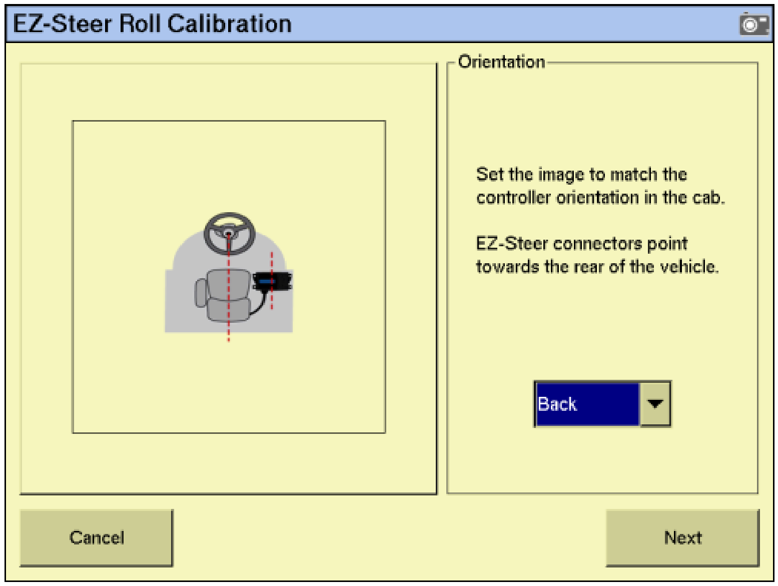
Calibrating T2 roll compensation

The EZ-Steer system contains sensors that use T2 terrain compensation technology to provide roll compensation when the vehicle is on a slope or drives over a bump. For roll compensation to work correctly, the controller must be calibrated.

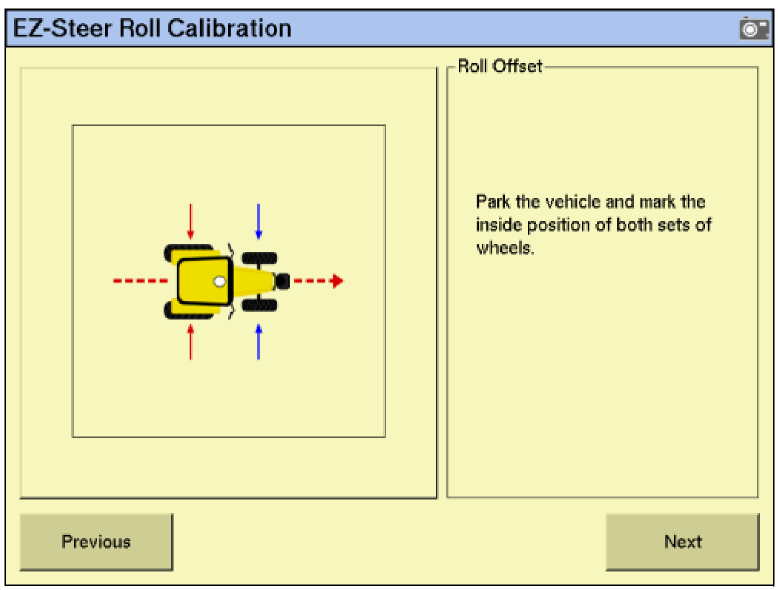
1. Select the EZ-Steer plugin and then tap **Calibrate**:



2. Select *Controller Orientation*:



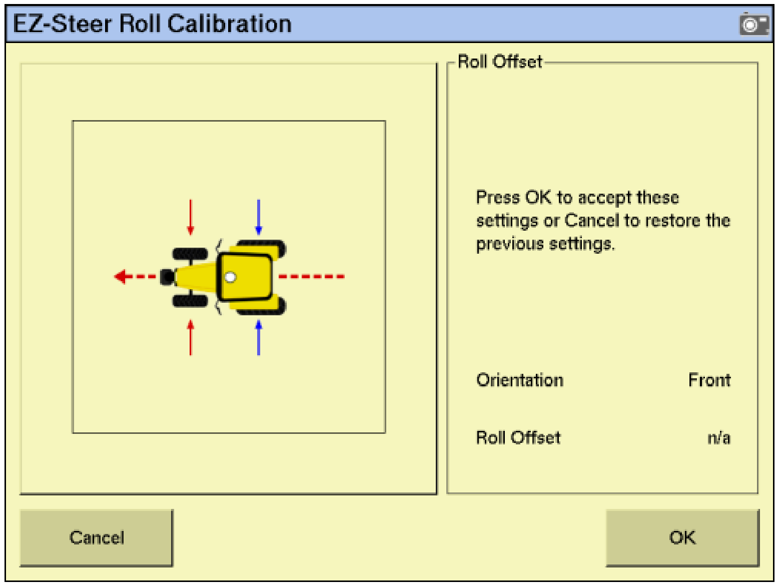
3. From the *Orientation* drop-down list, select the orientation of the SCM (steering control module) and then tap **Next**:



4. Park the vehicle, mark the inside position of both sets of wheels and then tap **Next**.

   The display records the roll offset in the first direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.

5. Turn the vehicle around, ensure the wheels are parked over the marks created in Step 4 and then tap **Next**:



The display records the roll offset in the second direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.

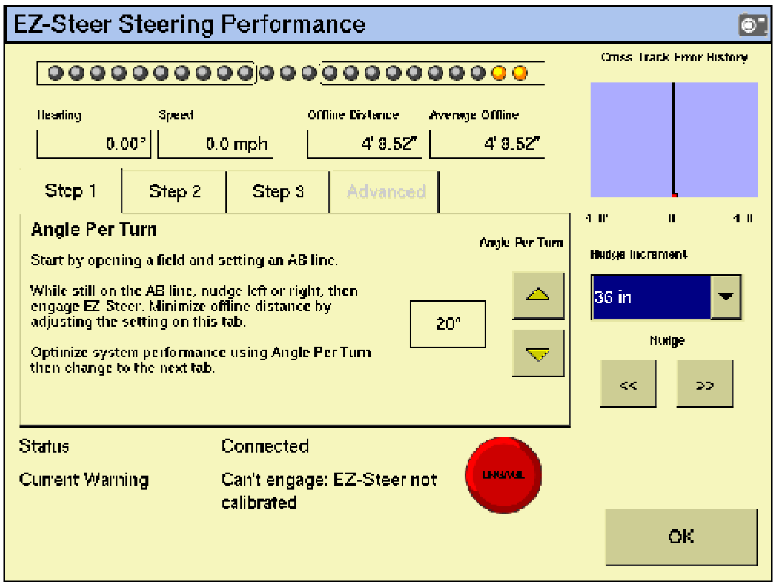
6. The T2 calibration results will appear in the *Roll Offset* window. The Roll Offset value should be between 0° and 4°.

7. Tap **OK**. The *EZ-Steer Steering Calibration* screen appears.

Calibrating and setting the EZ-Steer parameters

To calibrate the EZ-Steer system, and set the correct steering performance parameters, the following steps must be completed with the vehicle moving forward along the A-B line.

1. From the *EZ-Steer Steering Calibration* screen, select *Steering Performance*. The *EZ-Steer Steering Performance* screen appears.
2. To configure the *Angle per Turn* settings, select the *Step 1* tab:



This is the angle that the wheels turn through during one full rotation of the steering wheel. This is a course aggressiveness adjustment. If the setting is too low, the system may require several attempts to reach the line.

With the vehicle moving forward along the A–B line:

a. Nudge the vehicle left or right 1 m (3') from the A–B line.

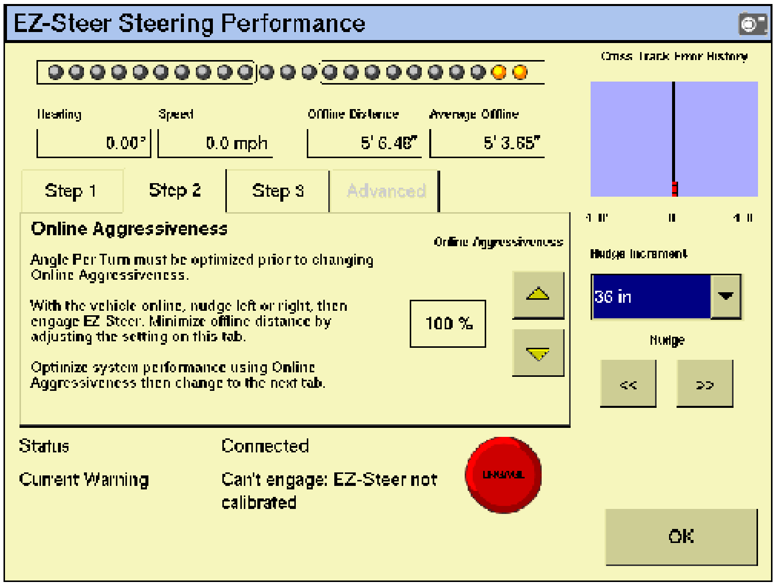
b. Engage the EZ-Steer system.

c. Adjust the *Angle per Turn* value so that when the system is engaged, the vehicle moves close to the guidance line.

To make...	Do the following...
More aggressive turns	Decrease the *Angle per Turn* value.
Less aggressive turns	Increase the *Angle per Turn* value.

***Note –** Use the Cross Track Error history plot on the top right of the page and the Average Offline distance to optimize EZ-Steer performance for each step in the calibration.*

3. To configure the *Aggressiveness* settings, select the *Step 2* tab:

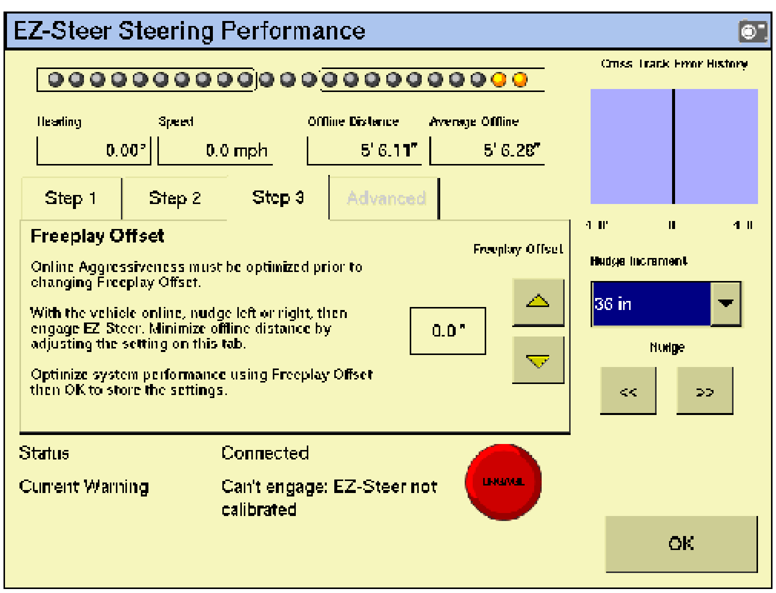


The Aggressiveness setting fine-tunes how aggressively the system holds the line. If the setting is too low, the vehicle will not hold the line; if the setting is too high, the vehicle may over-correct and make S-turns.

4. Adjust the *Aggressiveness* setting to get the vehicle as close to the line as possible without going into S-turns.

To make...	Do the following...
More aggressive turns	Increase the *Aggressiveness* value.
Less aggressive turns	Decrease the *Aggressiveness* value.

5. To adjust the *Freeplay Offset* settings, select the *Step 3* tab:



Add a Freeplay Offset if the steering has greater freeplay in one direction than the other, causing it to drive consistently to one side of the guidance line.

6. Engage the system on the A–B line.

Vehicle is offline…	Do the following…
To the left	Increase the freeplay offset to the right.
To the right	Increase the freeplay offset to the left.

Note – *If you are calibrating a 4WD articulated vehicle, you may need to set the Motor Speed setting to Auto Low.*

Note – *The Advanced Calibration tab is currently not available. To access these options, select the EZ-Steer plugin* **Diagnostics** *from the main Configuration screen.*

7. Enter the parameters and then tap **OK**. The *EZ-Steer Steering Calibration* screen appears.

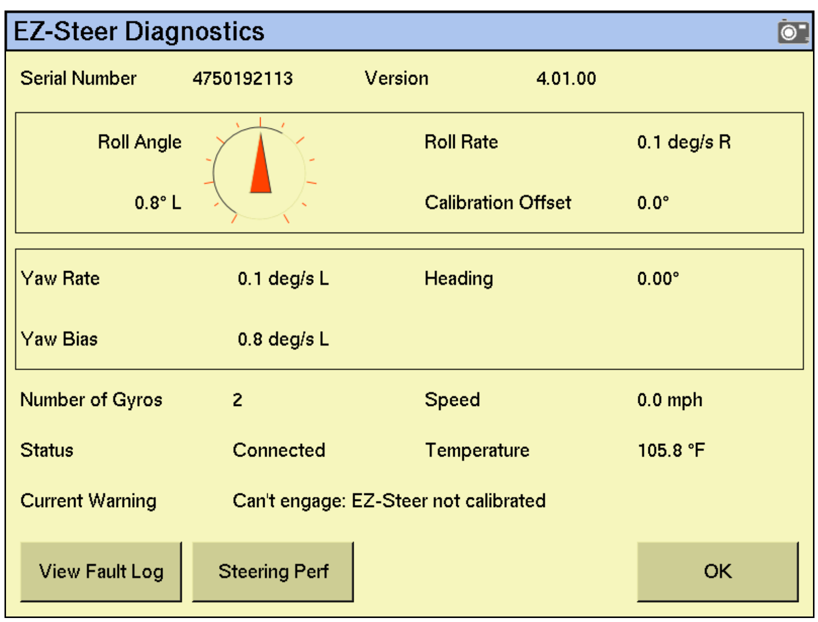
8. Tap **OK**. The *Configuration* screen appears.

EZ-Steer plugin diagnostics

The *EZ-Steer Diagnostics* screen displays the SCM statistics and inertial information.

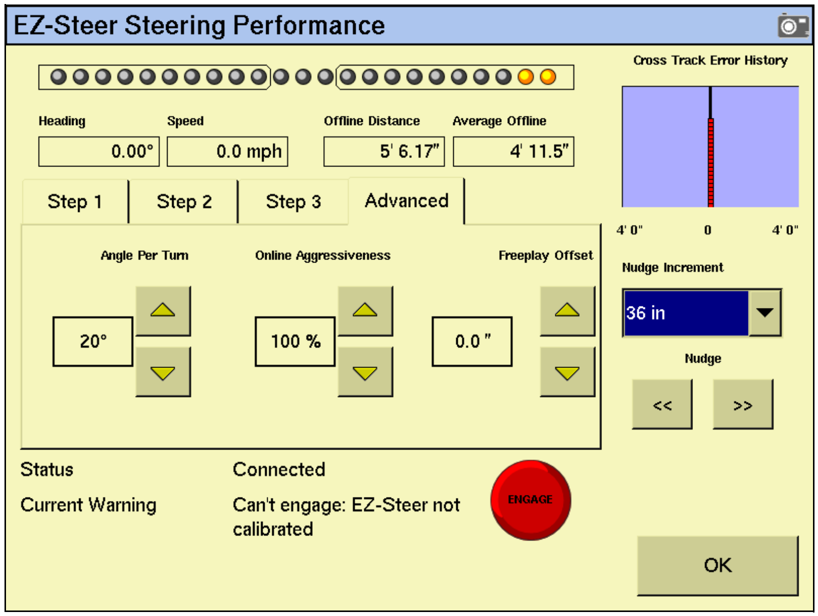
1. From the *Configuration* screen, select the EZ-Steer plugin and then tap **Diagnostics**. The *EZ-Steer Diagnostics* screen appears.

   This screen displays the roll and heading of the vehicle, and the temperature of the steering control module:



2. Tap **Steering Perf**. The *EZ-Steer Steering Performance* screen appears.

This screen is for advanced users who understand how to adjust EZ-Steer performance. If you are not an advanced user, Trimble recommends that you follow the numbered tabs to adjust the steering parameters. See Calibrating and setting the EZ-Steer parameters, page 158:



3. In the *Advanced* tab, make the required changes and then tap **OK**. The *Configuration* screen appears.

Operating the EZ-Steer system with the FM-1000 integrated display

Engage options

The *Engage Options* tab enables you to control the system's engage and disengage behavior if you need to change the automatically populated settings.

1. From the *Configuration* screen, select the EZ-Steer plugin and then tap **Setup**. The *EZ-Steer Settings* screen appears.
2. Select the *Engage Options* tab. The following options appear:

Option	Description
Minimum speed	Minimum speed at which the system can engage. If the system is engaged and the speed drops below this limit, the system disengages.
Maximum speed	Maximum speed at which the system can engage. If the system is engaged and the speed increases above this limit, the system disengages.
Maximum angle	Maximum angle at which the system can engage. If the vehicle approaches the swath at an angle greater than this limit, it cannot be engaged.

Option	Description
Engage offline	Maximum distance from the swath at which the system can engage. If the vehicle approaches the swath at a distance greater than this limit, it cannot be engaged.
Disengage offline	Maximum distance from the swath at which the system can remain engaged. If the vehicle drives offline greater than this limit, the system disengages.
Engage on A–B	Configure whether the system can be engaged on the master A–B line.
Override sensitivity	Amount the steering wheel must be turned manually before the system disengages.
EZ-Steer external switch	Configure the behavior of a seat/foot switch.

3. Configure the *Engage Options* as required and then tap **OK**. The *Configuration* screen appears.

Engaging the system

To engage the EZ-Steer system, you must have an open field in the Run screen, and have an A–B line defined. The vehicle must be within the engage limits configured in EZ-Steer systems *Engage Options*.

To manually engage the EZ-Steer system, do one of the following:

- Tap the engage button on the main guidance screen, or press the engage button on the optional remote control.
- Press the optional remote engage foot pedal.

Disengaging the system

Turning the steering wheel manually disengages the EZ-Steer system. Trimble recommends that you check this setting before you start using the system in a new installation by engaging on a line and then turning the wheel until EZ-Steer disengages. To adjust the amount of force required to disengage the system, change the *Override Sensitivity* in the *EZ-Steer Setup* screen. The EZ-Steer system automatically disengages when:

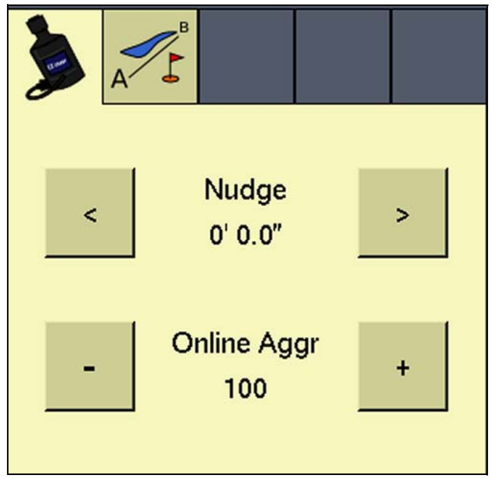
- The vehicle is outside the engage limits configured in the *Engage Options* screen.
- The system is paused.
- GPS positions are lost.
- The *Minimum Fix Quality* setting is set to a high accuracy correction method and the system receives low accuracy positions (for example, no corrections).
- To manually disengage the system, do one of the following:
  - Tap the engage button on the main guidance screen or press the engage button on the optional remote control.
  - Turn the steering wheel to override the electric motor.

– Press the optional remote engage foot pedal.

When the system is not in use, hinge the motor away from the steering wheel and then secure it with the lock pin.

EZ-Steer plugin screen

The EZ-Steer tab on the Run screen shows the current nudge increment and online aggressiveness values.



- Tap either the **<** or **>** button to increase or decrease the *Nudge Increment* setting by the distance set in the *Steering Settings* setup screen.
- Tap either the **-** or **+** button to increase or decrease the Online Aggressiveness setting by +/- 5%. The default value is set in the *Steering Settings* setup screen.

Vehicle-specific performance

Before you use the EZ-Steer system, Trimble recommends that you consider the following vehicle-specific performance suggestions.

Vehicle type	**Performance hint**
2WD tractor	For an EZ-Steer system installed on tractors that have SuperSteer (for example, New Holland TG). If the tractor has a SuperSteer front axle, for best performance: • Reduce the Online Aggressiveness value. • Line up close to the swath and make certain that the front wheels are straight before engaging the EZ-Steer system. • To get smoother performance when the vehicle is pulling an implement over tilled ground, enable the Diff-Lock. This prevents the machine from pulling sharply to the left or right. If you are calibrating on a hard surface, turn off Diff-Lock.
4WD tractor	The EZ-Steer system can be installed on Case IH STX tractors with Accusteer. For optimal performance, disable Accusteer using the switch in the cab (if possible).

Vehicle type	Performance hint
Sprayer	• It is common for these vehicles to have slow steering. To compensate for this, use high aggressiveness. • If you experience large, slow oscillations, increase the aggressiveness. • When you configure the system on a sprayer, the Sprayer steering delay setting is available on the *Vehicle Setup* screen. • Some sprayers have steering that is slow to react after you turn the steering wheel.The system uses the steering delay setting to compensate for this slowness and ensure that steering corrections occur at the correct point.
Swather	• When you configure the system on a swather, the Swather steering delay setting is available on the Vehicle Setup screen. • Some swathers have steering that is slow to react after the steering wheel is turned. The system uses the steering delay setting to compensate for this slowness and ensure that steering corrections occur at the correct point. • To improve the performance of your swather, adjust the Swather steering delay setting by a small amount (0.1 seconds) at a time. Test the result between each adjustment

After using the EZ-Steer system

After you finish using the EZ-Steer system, do the following:

- ***Before*** you leave the vehicle, turn off the EZ-Steer system power switch or remove the power plug.
- If the EZ-Steer system is not being used, pivot the motor away from the steering wheel.

CHAPTER

6

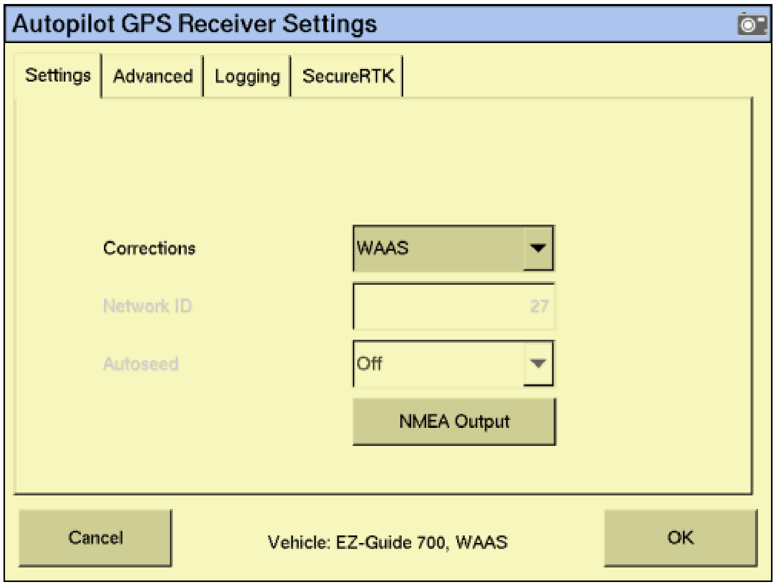
The GPS Receiver

When you install either the Manual Guidance option, the Autopilot option, or the FieldLevel II plugin, the system automatically adds a GPS Receiver option that controls the internal GPS receiver.

In addition, the system may have another GPS receiver. For example, the TrueTracker system uses a second receiver that is configured with a separate GPS Receiver option. This chapter describes how to configure the four versions of the GPS Receiver option.

Configuring the GPS receiver

1. From the *Configuration* screen, select the GPS Receiver option and then tap **Setup**:

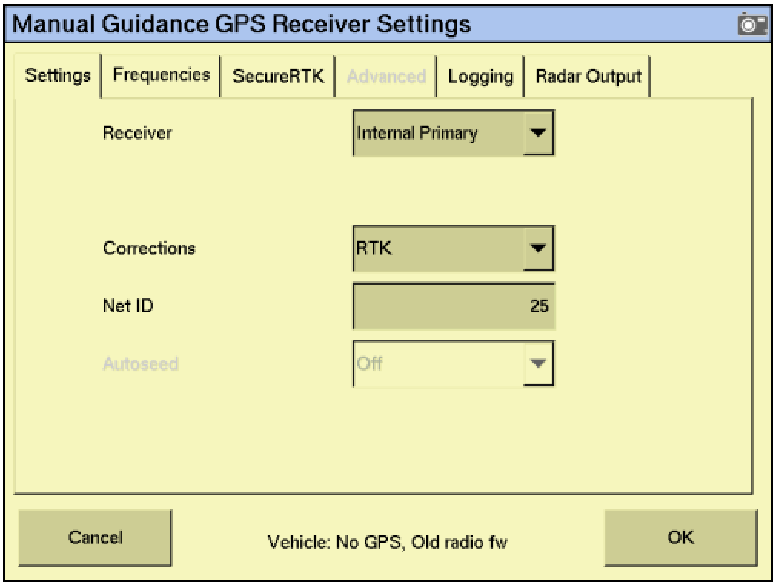


2. In the *Corrections* drop-down list, tap the appropriate corrections to use.
3. If RTK corrections are selected, enter the appropriate base-station network ID.
4. If HP/XP type corrections are selected, the Autoseed™ technology options become available. For more information see Autoseed fast restart technology, page 170.

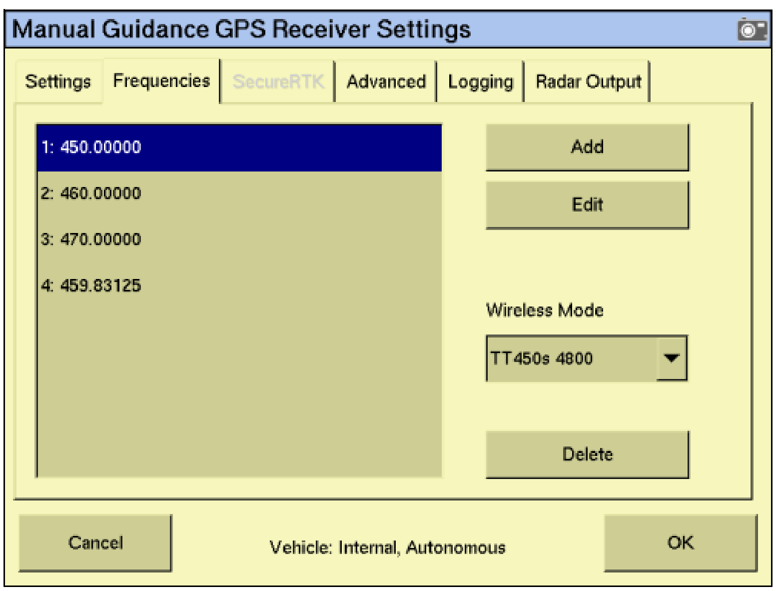
Entering 450 MHz frequencies

If your FM-1000 integrated display has a 450 MHz internal radio, you can set the radio frequency and radio wireless modes.

1. From the *Configuration* screen, select the GPS Receiver option and then tap **Setup**:

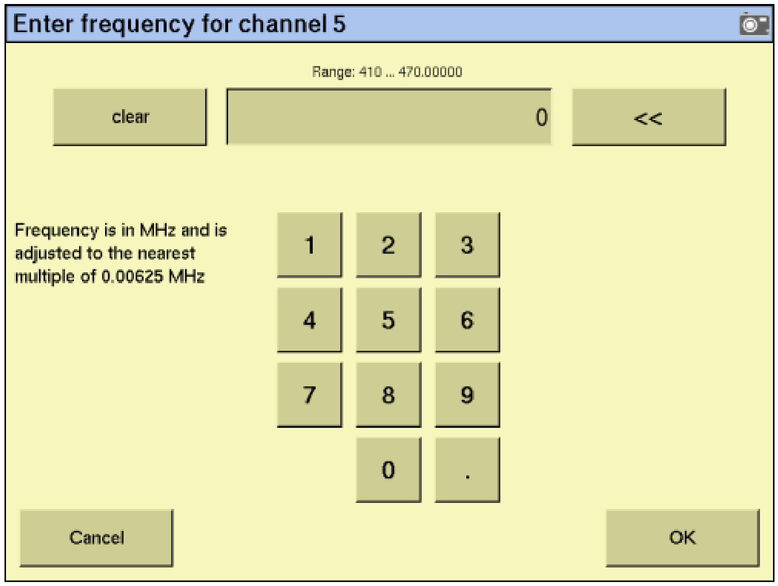


2. Select the *Frequencies* tab. The list of current frequencies appears:



Note – *Up to 19 different frequencies can be stored.*

3. To add a new frequency, tap **Add**:



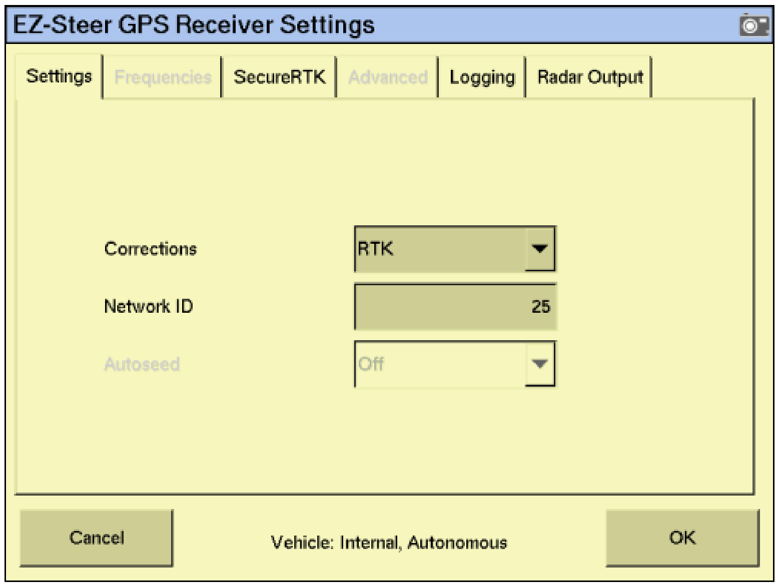
4. Enter the required frequency for the next available channel and then tap **OK**. The *GPS Receiver Settings* screen appears.

5. From the *Wireless Mode* drop-down list, select the appropriate mode and then tap **OK**.

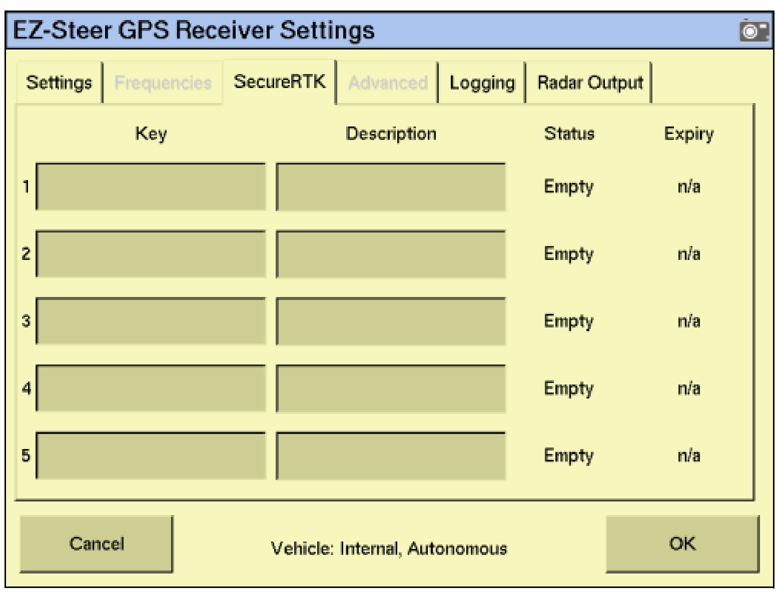
Enabling SecureRTK

SecureRTK is a Trimble proprietary base station security feature that enables a Trimble RTK base station service provider to generate time-based access codes for their supported rovers. SecureRTK requires firmware version 1.59, or later, on MS750™ GPS receivers, and firmware version 3.67 on AgRTK and *Ag*GPS 442 base stations.

1. From the *Configuration* screen, select the GPS Receiver option and then tap **Setup**:



2. Select the *SecureRTK* tab.



3. In the *Key* field, enter the base station access code provided by your base station service provider.

The *Status* and *Expiry* fields change to show the current status of the security feature.

4. (Optional) In the *Description* field, enter the name of the base station.
5. Tap **OK**.

If SecureRTK is enabled on the base station, rovers with authorized access codes can use corrections from that base.

***Note** – Rovers without a SecureRTK access code are unable to access a secure Trimble RTK base station.*

Autoseed fast restart technology

Autoseed fast restart technology greatly reduces the time needed for OmniSTAR HP/XP/VBS convergence. Once the OmniSTAR signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown.

To benefit from Autoseed technology:

- you must use OmniSTAR HP or XP corrections
- shut down the receiver
- do not move the vehicle before you turn on the receiver again
- the GPS receiver must have a clear view of the sky

***Note** – Vehicle movement will result in unsatisfactory performance, including longer convergence times and positional offsets.*

To enable the Autoseed technology:

1. On the *Configuration* screen, select the GPS Receiver option and then tap **Setup**. The *GPS Receiver Settings* screen appears.
2. In the *Corrections* drop-down list, select either OmniSTAR HP/XP or OmniSTAR HP/XP-VBS.

   The **Autoseed** button becomes available.
3. Select **Autoseed** and then tap **OK**.

Configuring a GPS receiver with the AgRemote software

The FM-1000 integrated display has a virtual AgRemote interface for manually adjusting GPS receiver settings. This is recommended for advanced users only.

To access the virtual AgRemote interface:

1. From the *Configuration* screen, select the GPS Receiver option and then tap **Diagnostics**. The *GPS Status* screen appears.
2. Tap **AgRemote**. The virtual AgRemote interface appears.

   For more information on the correct use of the AgRemote interface, refer to the *AgRemote Software Guide for Ag*GPS *Receivers* on www.trimble.com.

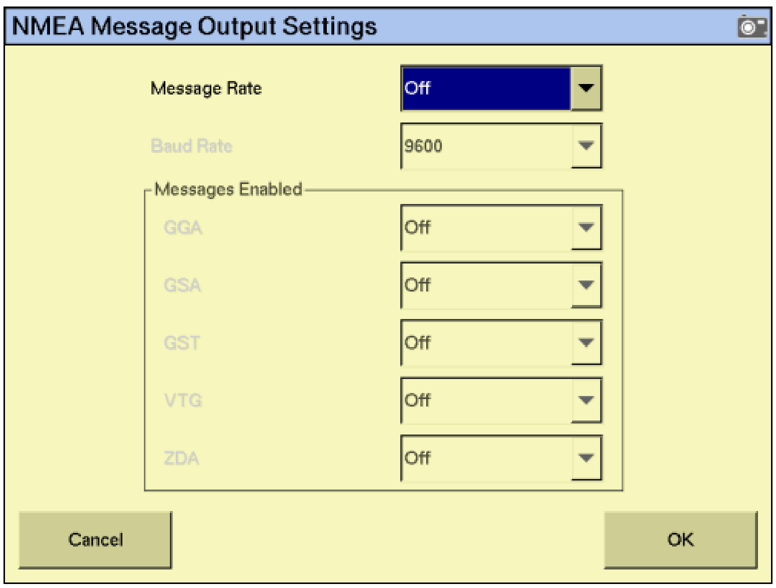
Enabling NMEA message output

The NMEA message formats are a standard format through which GPS receivers can communicate. If you have an external device connected to the Autopilot controller, you can enable NMEA message output from the controller so that the device receives NMEA GPS positions.

The messages are output through the NavController harness laptop connector.

Some GPS receivers can output NMEA messages to an external device. To do this:

1. On the *Configuration* screen, select the GPS Receiver option and then tap **Setup**. The *GPS Receiver Settings* screen appears.
2. Tap **NMEA Output**:

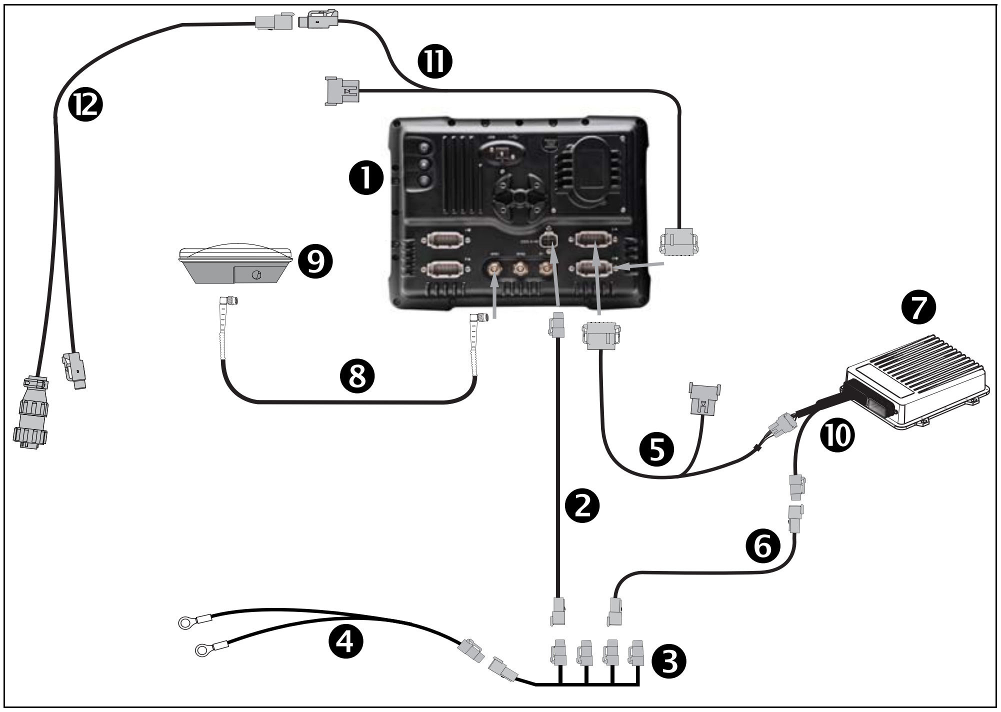


3. Select the appropriate Message Rate and then the Baud Rate.
4. In the *Messages Enabled* group, select the appropriate NMEA message types to output. Do not just enable all formats.
5. Tap **OK** to continue.

***Note –** To enable NMEA output from another receiver (for example, the GPS receiver connected to an TrueTracker system controller), select the plugin for that receiver in the plugin list.*

Enabling radar output

The FM-1000 integrated display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor. Radar pulses are available from port C or port D of the display.



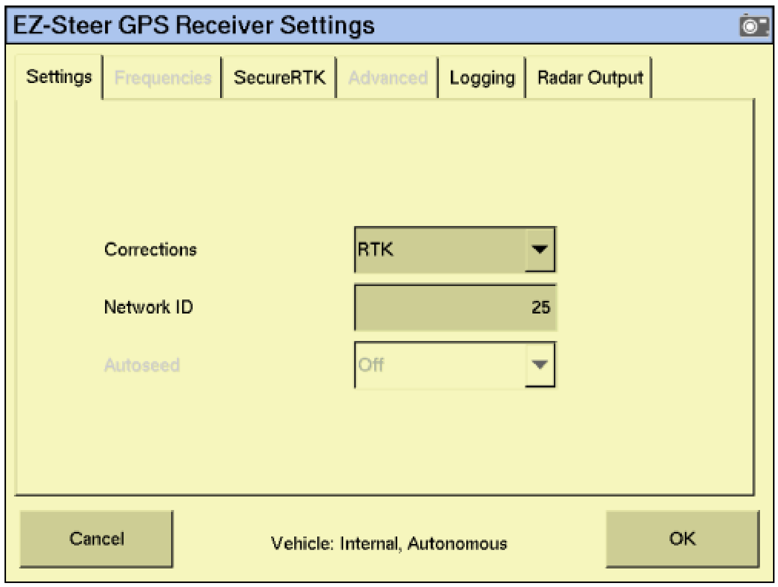
CAUTION – Connecting the Port Replicator on the FM-1000 to NavController II cable ❺ to the P4 or P12 connector of the NavController II harness ❿ will result in damage to the FM-1000 integrated display, and will void the warranty.

Item	Description	Trimble part number
❶	FM-1000 integrated display	93100-01
❷	FM-1000 power cable	66694
❸	FM-1000 power cable with relay and switch (power bus)	67259
❹	Basic power cable	67258
❺	FM-1000 to NavController II cable with port replicator	75741
❻	2 pin DTM to 2 pin DT power adaptor	67095
❼	NavController II	55563-00
❽	8m GPS TNC/TNC RT angle cable	50449
❾	AG25 GNSS antenna	68040-00S
❿	Main NavController II cable	54601

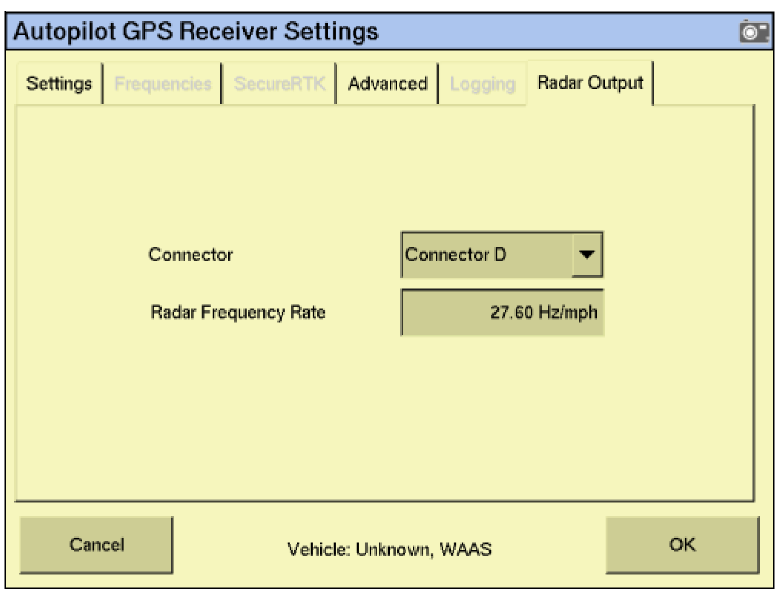
Item	Description	Trimble part number
⓫	FM-1000 universal radar adaptor	68461
⓬	Radar speed output cable	64274

Configuring radar output

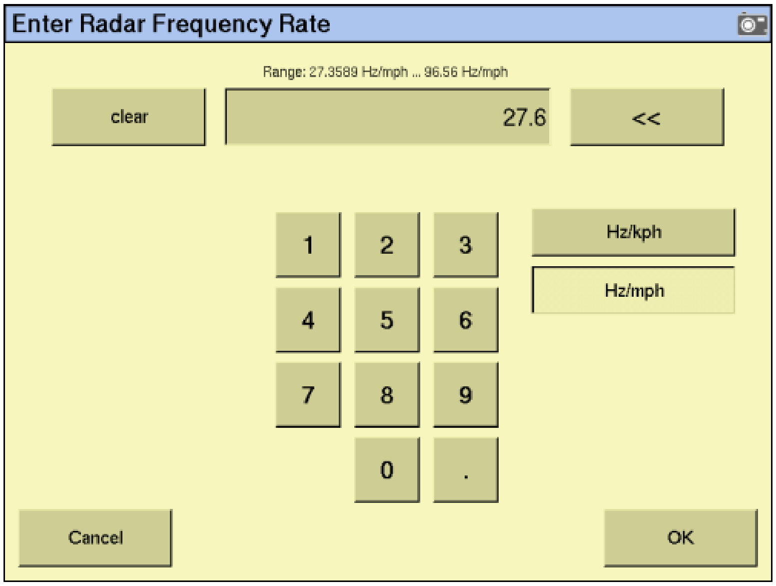
1. From the *Configuration* screen, select the GPS receiver for any plugin using an internal GPS receiver and then tap **Setup**:



2. Select the *Radar Output* tab.
3. From the *Connector* drop-down list, select *Connector D* to enable radar output:



4. Select the *Radar Frequency Rate* field:



5. Enter the required rate and then tap **OK**. The *GPS Receiver Settings* screen appears.
6. Tap **OK**.

CHAPTER

7

Implement Configuration

In this chapter:

This chapter describes how to configure a vehicle implement. For more information, see Chapter 24, Advanced Configuration.

You must configure your implement so that the system can tell:

- which type of implement is attached
- how much area it covers
- how far offset it is

***Note –** Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the **Home** button. When prompted to close the field, tap **Yes**.*

Introduction

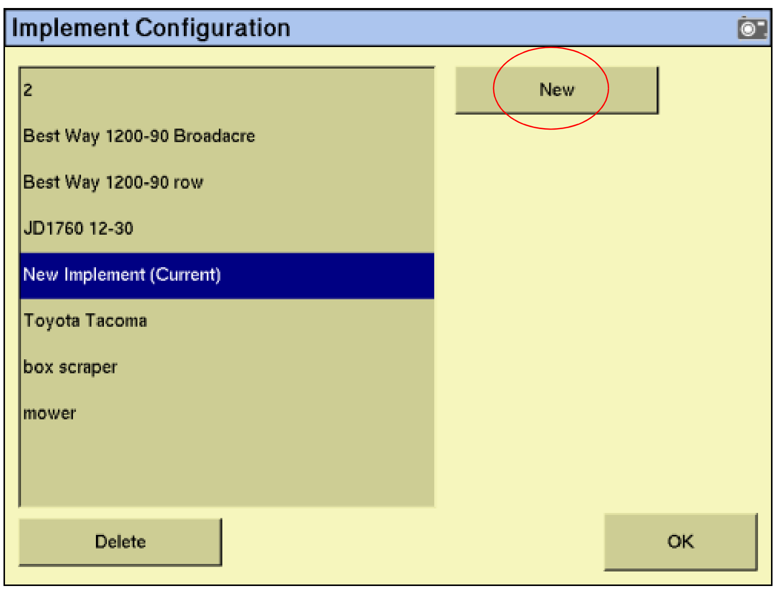
To obtain an implement, do one of the following:

- Create a new implement, see below.
- Select an existing implement, see page 178.
- Import an implement that was created for the *Ag*GPS 170 Field Computer, see page 189.

Once you select an implement, adjust its settings. See page 178.

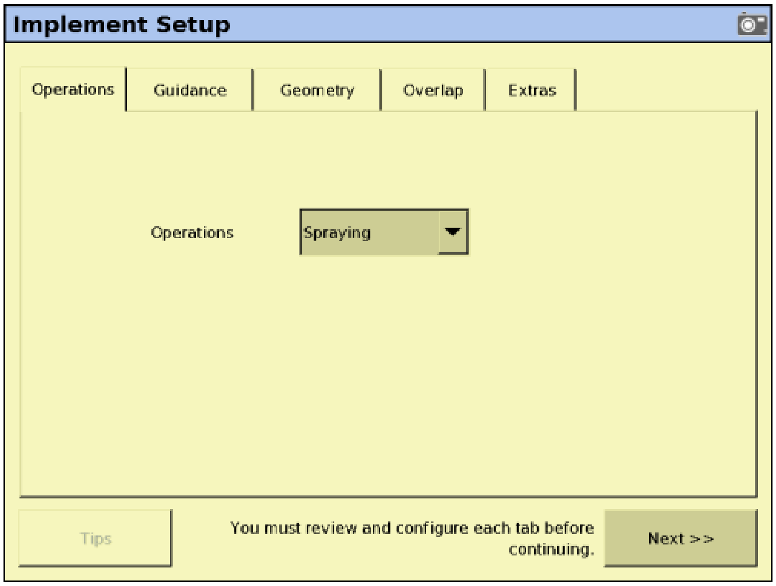
Creating an implement

1. From the Home screen, tap .
2. In the *Configuration Selection* screen, tap the implement **Switch**.
3. If necessary, enter the Administration password (see Password access, page 81).
4. In the *Implement Configuration* screen, tap **New**:



5. The *New Configuration Name* screen (with a virtual keyboard) appears.

6. Enter a name for the new implement and then tap **OK**. The *Implement Setup* screen appears:



For more information on configuring the implement, see Adjusting the implement settings, page 178.

7. After the implement setup has been completed, the *Select Active Plugins* screen appears.

8. Select the plugin or application to be used with the newly created implement and tap **Add >**. The plugin or application will be added to the *Active Plugins* list.

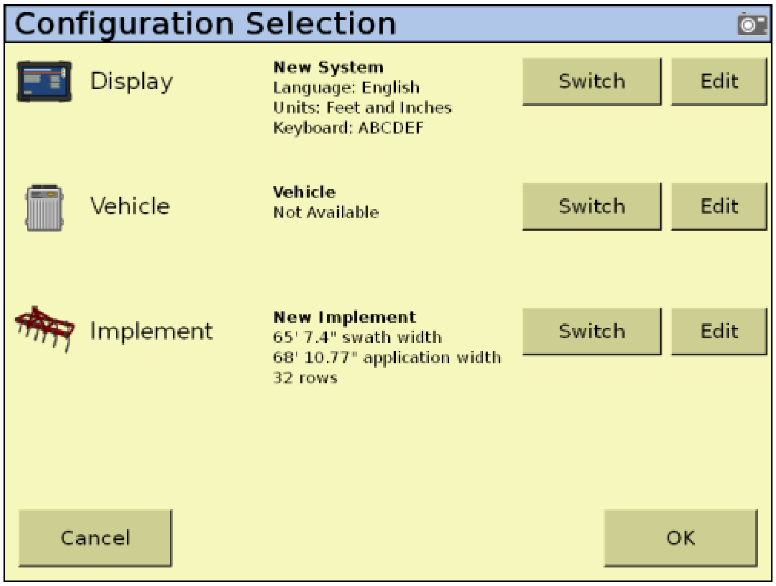
9. Tap **OK**.

Your current configuration now appears in the *Configuration* screen.

Selecting an existing implement

To select a pre-configured implement:

1. From the Home screen tap .



2. In the *Configuration Selection* screen, tap **Switch**.
3. If necessary, enter the Administration password. See Password access, page 81.
4. In the *Implement Configuration* screen, select the implement you want to switch to and then tap **OK**.

***Note** – If there is only one available implement, it is selected by default.*

The currently selected implement is displayed in the *Configuration Selection* screen.

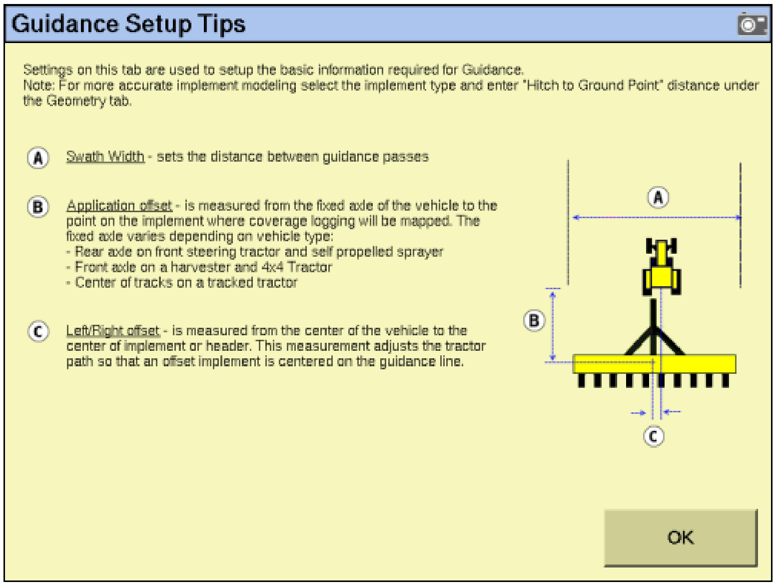
Adjusting the implement settings

On the FM-1000 integrated display, the implement setup screens contains five sections:

In this section	Definition
Operations	Describes the primary task for the current implement.
Guidance	The basic information required for guidance using the EZ-Steer system, or the Autopilot system.
Geometry	More detailed implement dimensions required for better implement modeling both with and without a GPS receiver on the implement.
Overlap	Values required to apply or avoid overlap.
Extras	Provides access to the *Variety Setup* options and remote log switch configuration.

Tips for implement configuration

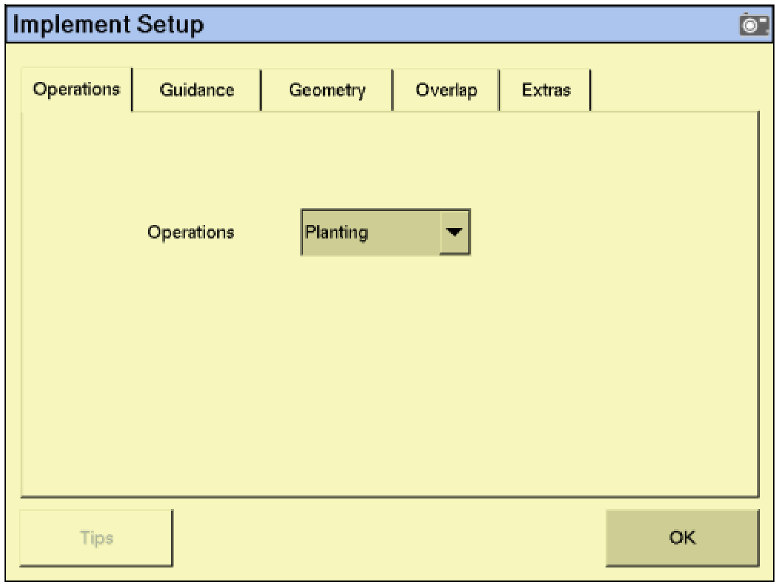
Each of the tabs in the *Implement Setup* screen has a **Tips** button. Tap this button to view information about the settings that you can enter in each tab. Tap **OK** to return to the *Implement Setup* screen:



If you are configuring a new implement on the FM-1000 integrated display, the display guides you through the process by prompting you to navigate to the following tab with a **Next** button.

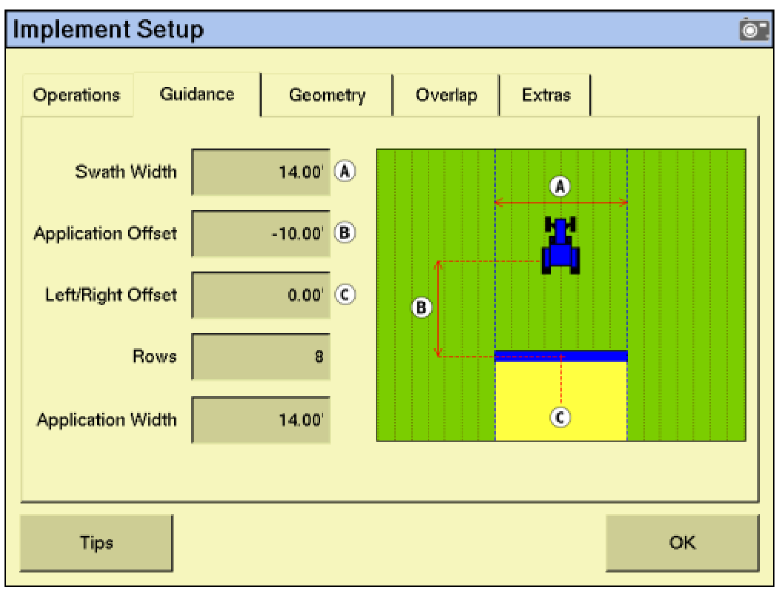
If you are editing an existing implement, you may chose which tab/s you would like to work through and then tap **OK** when you are finished.

Configuring the Operations setting



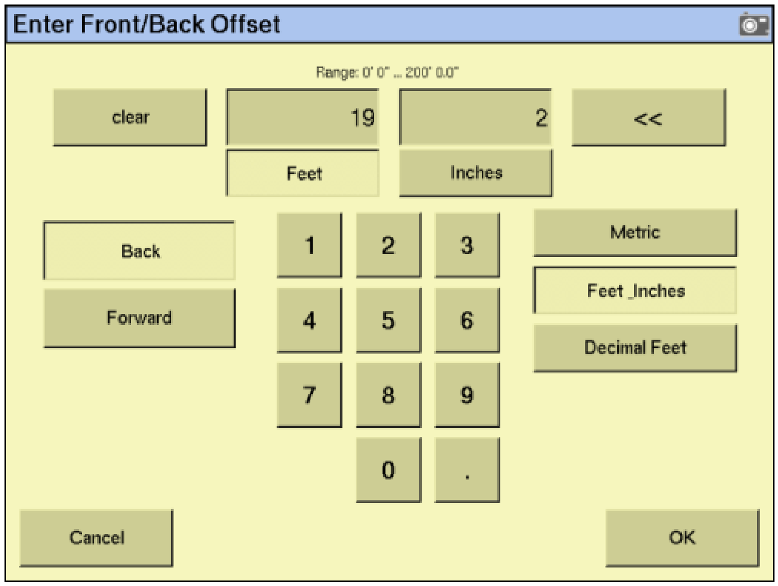
1. In the *Operations* tab, select the current task from the *Operations* drop-down list.
2. Tap **OK**.

Configuring the Guidance settings



1. In the *Guidance* tab, tap the *Swath Width* field and then enter a value to create an overlap. Tap **OK**.
2. To enter the front/back offset setting, tap the *Application Offset* field.

CAUTION – You must configure the correct front/back offset. If you are using an Autopilot system alone, set the front/back offset to the distance from the rear axle of the vehicle to the implement. If you are using any of the plugins that include switching (Field-IQ, Serial Rate Control, Tru Application Control, or EZ-Boom), set the front/back offset to the distance from the antenna to the implement.



a. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to change the units that the offset is measured in.

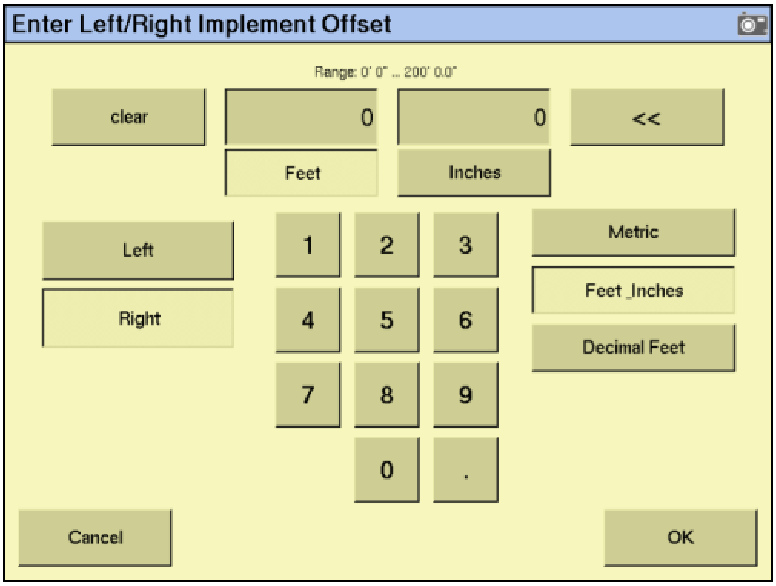
b. Enter the offset distance.

c. Tap either **Back** or **Forward** to select the direction of the offset. A forward offset that indicates that the implement is located ahead of the antenna position.

d. Tap **OK**. The *Implement Setup* screen appears. The image of the vehicle shows the offset that you just set.

Note – *The screen is scaled to the swath or application width—whichever is larger. If any offset is greater than this, the tractor image may pass the edge of the screen.*

3. If the implement is offset to one side, enter the left/right offset setting by tapping the *L/R Offset* field:



   a. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to change the units that the offset is measured in.

   b. Enter the offset distance.

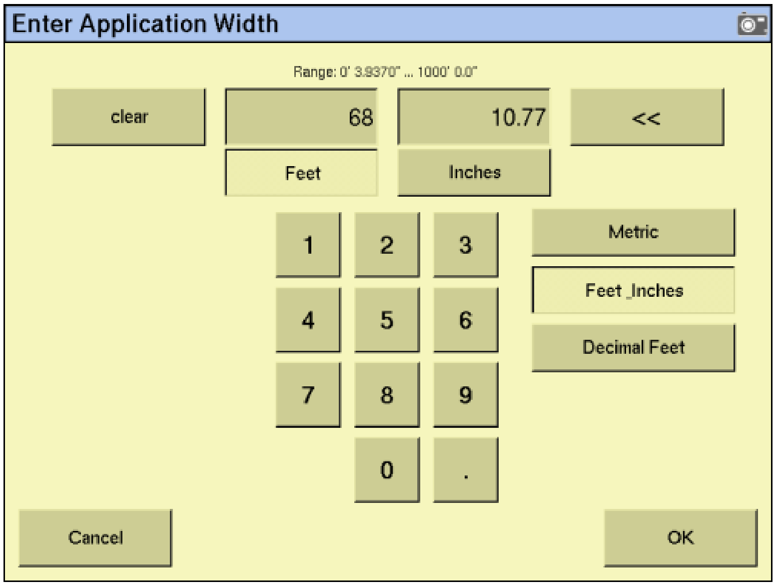
   c. Tap either **Left** or **Right** to select the direction of the offset. An offset to the left indicates that the implement extends to the left of the driver when seated in the vehicle.

   d. Tap **OK**. The *Implement Setup* screen appears. The image of the vehicle shows the offset you have just set.

4. Tap the *Rows* field, enter the number of rows that span across the swath width and then tap **OK**.

***Note** – This setting is used for navigation; in the Run screen, when you tap **Skip** to adjust the guidance line, the guidance line moves across by this number of rows.*

5. Tap the *Application Width* field:



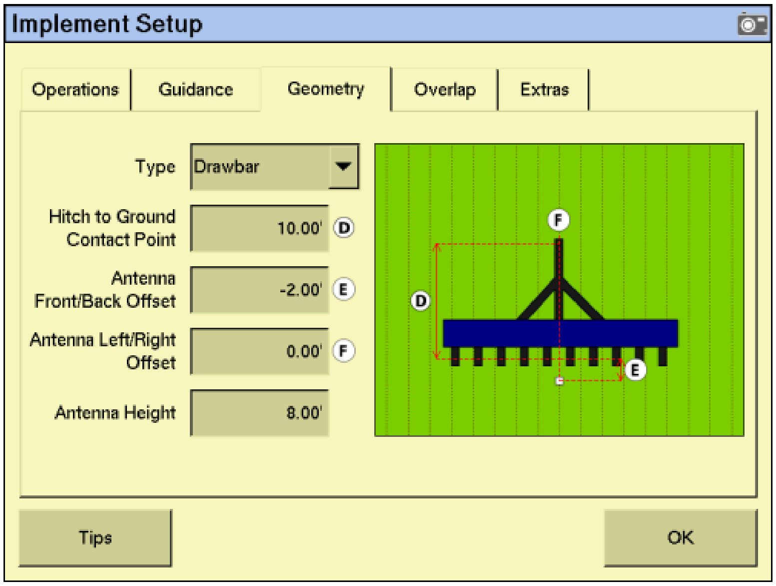
   a. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to select the units that the offset is measured in.

   b. Enter the distance from one end of the implement to the other. Set the *Application Width* value to slightly more than the *Swath Width* value.

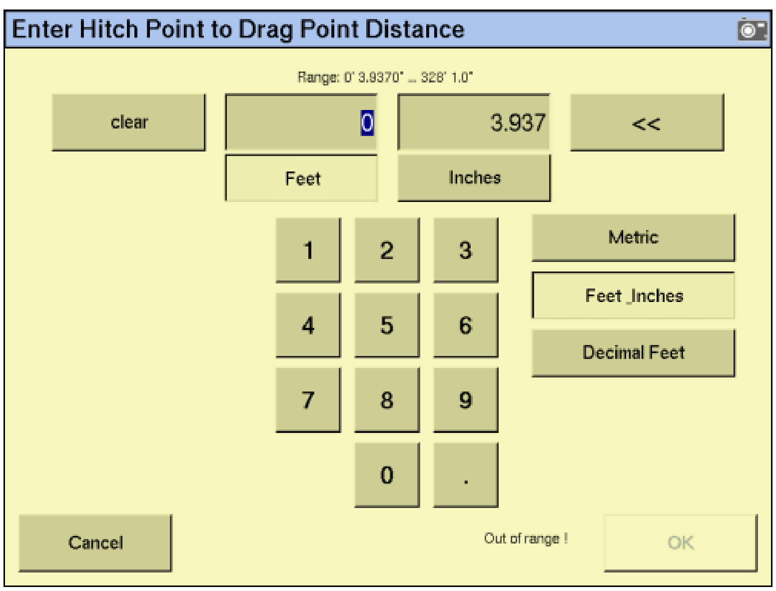
   c. Tap **OK**.

6. Tap **Next**.

Configuring the Geometry settings



1. From the *Type* list, select the implement type:
   - Hitch/3pt: the implement is fixed to the vehicle
   - Drawbar: the implement can pivot (like a trailer)
2. Select the *Hitch to Ground Contact Point* field:



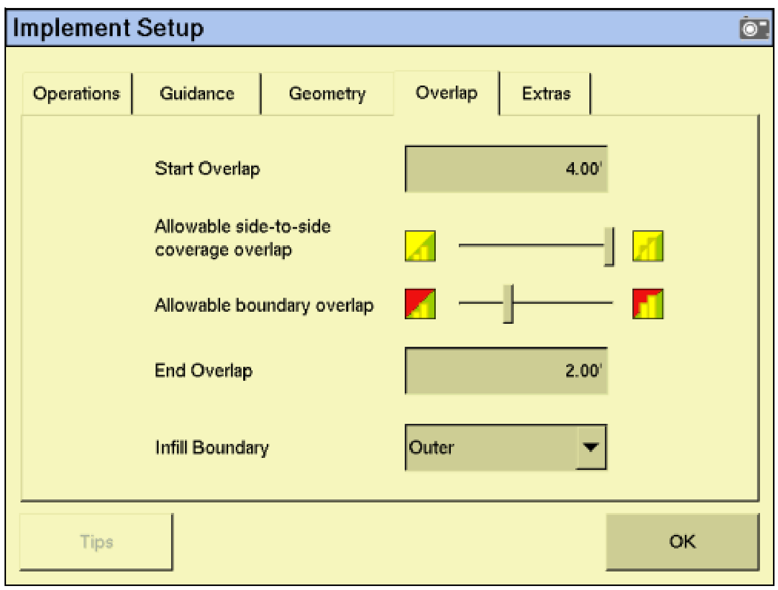
Entering a *Hitch to Ground Contact Point* distance improves the modeling of the implement for section control. If you shorten this distance, it brings the implement online more quickly. This setting defaults to the *Application Offset* entered in the *Guidance* tab.

3. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to select the units that the offset is measured in.
4. Enter the hitch to ground contact point distance.
5. Tap **OK**.
6. Select the *Antenna Front/Back Offset*, *Antenna Left/Right Offset*, and *Antenna Height* fields and repeat Step 3 through Step 5 for each to enter the required distances and then repeat.

***Note** – Measure the antenna height vertically, from the ground to the base of the antenna.*

7. Tap **Next**.

Configuring the Overlap settings



1. Tap the *Start Overlap* field to enter a value for the deliberate start-of-run overlap distance.
   a. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to change the units that the overlap is measured in.
   b. Enter the overlap distance.
   c. To prevent an overlap of material, tap **Skip**. To apply an overlap of material, tap **Overlap**.
   d. Tap **OK**.
2. Adjust the *Allowable side-to-side coverage overlap* slider.

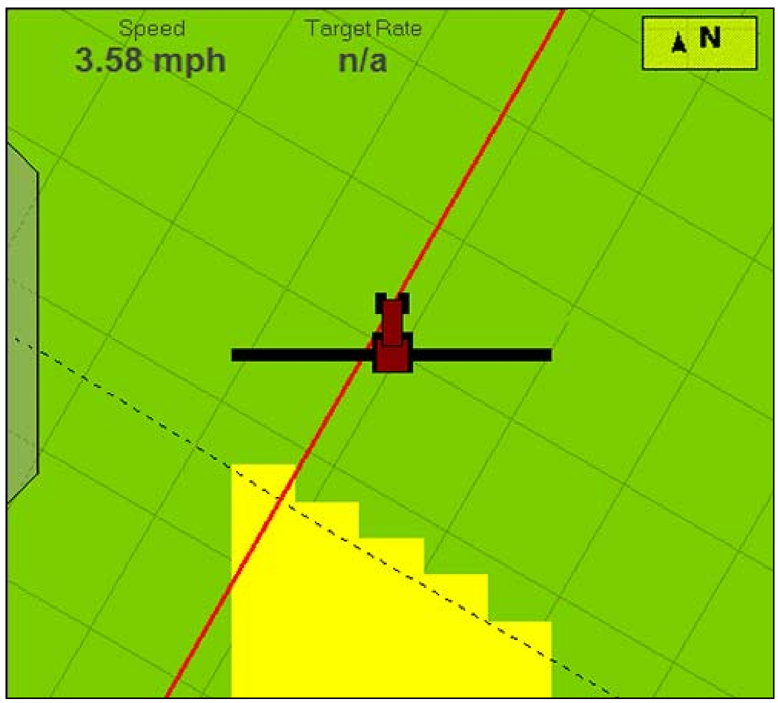
   If a section turns off when you are crossing a diagonal covered ground, there needs to be some overlap or some skip.

- To ensure that there is no coverage double-up, move the slider fully to the left. This results in some uncovered ground.
- To ensure that the system does not skip any ground, move the slider fully to the right. This results in some double-up.
- To have an even share of overlap and skip, move the slider to the middle.

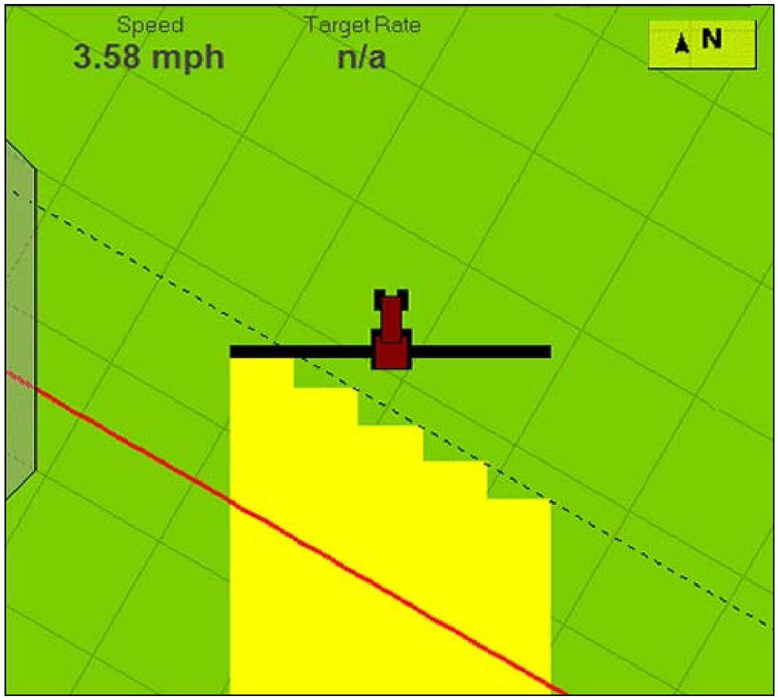
3. Adjust the *Allowable boundary* overlap slider.

   This applies to automatic section control. The slider bar adjusts the allowable overlap of the field boundary (headland and pivot patterns also apply) or exclusion zone. This setting is adjusted as a percentage of each section's width.

   - To ensure that no areas inside a boundary are left uncovered, set the slider all the way to the right. See the following Run screen example:



– To ensure that no area outside a boundary is covered, set the slider all the way to the left. See the following Run screen example:



4. Tap the *End Overlap* field to enter a value for the deliberate end-of-run overlap distance.

   a. If necessary, tap **Metric**, **Feet & Inches**, or **Decimal Feet** to change the units that the overlap is measured in.

   b. Enter the end overlap distance.

   c. To prevent an end overlap of material, tap **Skip.** To apply an end overlap of material, tap **Overlap**.

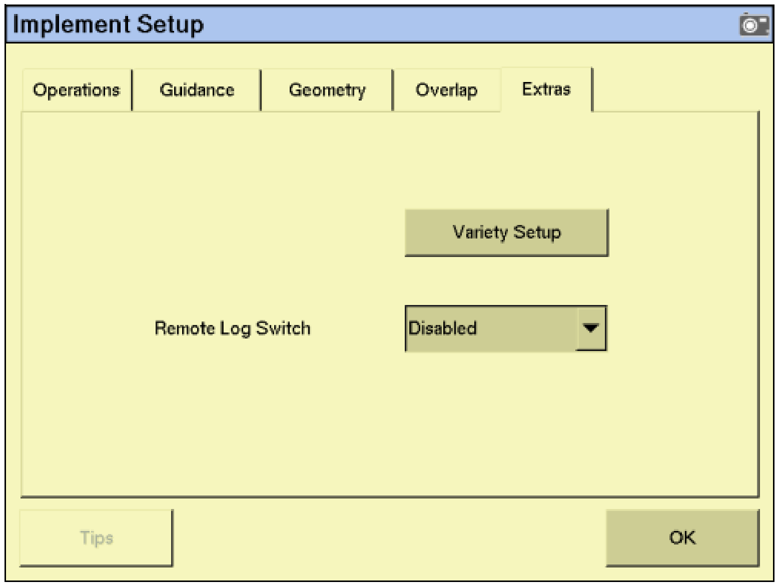
   d. Tap **OK**.

5. Select an *Infill Boundary* option from the drop-down list.

6. Tap **Next**.

Configuring the Extras tab

1. To access the *Variety Setup* menu, select the *Extras* tab:



For more information on allocating logging varieties, see Logging varieties, page 70.

2. If your system does not provide automatic coverage control, select a port connector for the floor-mounted switch from the *Remote Log Switch* list.

3. Tap **OK**.

The implement is now configured, and the settings are stored in the FM-1000 integrated display's internal memory.

To save the implement configuration:

1. In the *Configuration* screen, highlight *Implement*.

2. Tap **Save Config**.

3. When prompted, select *Save* (to save the current configuration) or select *New* (to create a new configuration). If you select New, you must then follow the steps for Adjusting the implement settings, page 178.

Importing an implement from the *Ag*GPS 170 Field Computer or the FieldManager display

The FM-1000 integrated display can import and use implements that were created in the *Ag*GPS 170 Field Computer or the FieldManager display.

To import an implement:

1. Copy the implement file into the *AgGPS* folder on the USB memory stick.
2. Insert the memory stick into the FM-1000 integrated display and then turn on the display.
3. From the Home screen, tap .
4. In the *Current Configurations* screen, tap **Configure**.
5. If necessary, enter the Administration password. See Password access, page 81.
6. In the *Configuration* screen, select *System* and then tap **Setup**
7. Select *Data Files* and then tap **Manage**.
8. Select *Implement* from the list on the left of the screen and then tap **Copy**.

   The implements from your *Ag*GPS 170 Field Computer or FieldManager display now appear in the *Implement Configuration* screen.

Deleting an implement

To delete an implement that you no longer require:

1. From the *Edit Implement* screen, select the appropriate implement from the *Current Implement* list.
2. Tap **Delete**.
3. When prompted, tap **Delete** to confirm the deletion.

CHAPTER

8

Overview of plugins

In this chapter:

This chapter explains the FM-1000 integrated display plugin, and how to configure plugins.

Note – *Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the Home button. When prompted to close the field, tap* ***Yes****.*

Introduction to plugins

The FM-1000 integrated display version 4.00 has a number of plugins that you can install to expand its functionality.

Most of these plugins require additional hardware to work correctly. For example, to use the display to perform water management with the FieldLevel II system, add the FieldLevel II plugin. This enables you to configure the FieldLevel II system settings, and adds the FieldLevel II screen items to the main guidance screen.

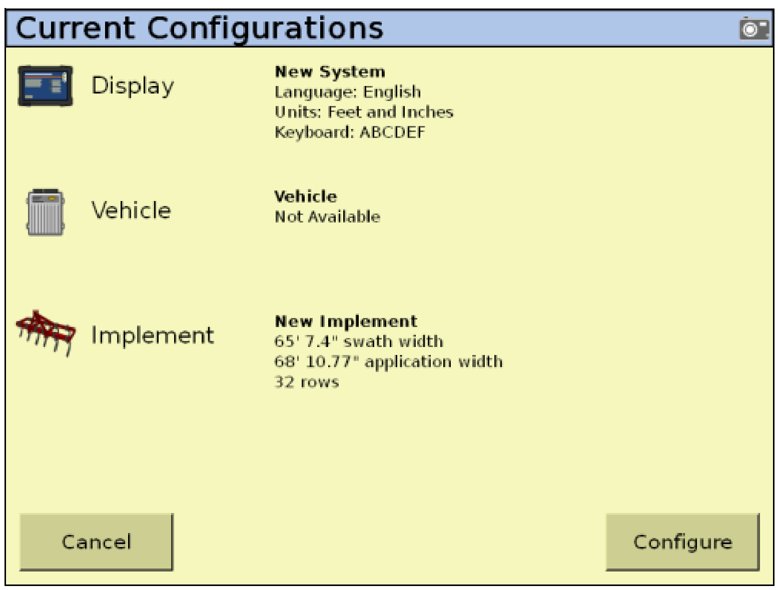
Item	Status	Description	See...
Ag3000 modem	Optional	Enable the Ag3000 GSM/GPRS cellular modem to receive RTK type corrections using VRS infrastructure network technology.	Chapter 21, The Ag3000 Modem
EZ-Remote joystick	Optional	Control a variety of display functions remotely.	Chapter 22, The EZ-Remote Joystick
LB25 external lightbar	Optional	Monitor your line with a second or third lightbar.	Chapter 23, The LB25 External Lightbar
FIeldLevel Survey / Design, FieldLevel II, Tandem/Dual	Optional	- Survey a field and then create a design. - Level the field to a design, install subsurface drainage or surface ditches. - Control leveling with two GPS receivers, in one of two possible scraper configurations.	Chapter 9, The FieldLevel II Plugins
Field-IQ	Optional	Configure the Field-IQ™ crop input control system to control sections and vary application rates.	Chapter 10, The Field-IQ Plugin
Tru Application Control	Optional	Configure a planter, drill, air seeder, spreader, sprayer, or anhydrous ammonia applicator for flow and application purposes.	Chapter 11, The Tru Application Control Plugin
GreenSeeker	Optional	Vary fertilizer rate in real-time using crop vigor measurements.	Chapter 12, The GreenSeeker Plugin
Yield monitoring	Optional	Access yield monitoring information from John Deere combines and Ag Leader displays.	Chapter 20, The Yield Monitoring Plugin
TrueGuide	Optional	Configure the TrueGuide™ implement guidance system for implement control.	Chapter 13, The TrueGuide Plugin
TrueTracker	Optional	Configure the TrueTracker™ system to enable implement steering.	Chapter 14, The TrueTracker Plugin
EZ-Boom	Optional	Configure the EZ-Boom 2010 automated application control system to enable spray boom and rate control.	Chapter 15, The EZ-Boom Plugin
Serial Rate Controller	Optional	Configure a non-Trimble variable rate controller.	Chapter 16, The Serial Rate Control Plugin

Item	Status	Description	See...
Remote Output	Optional	Enable and configure remote data output to an external device.	Chapter 17, The Remote Output Plugin
Serial Data Input	Optional	Enable and configure data input from an external serial device.	Chapter 18, The Serial Data Input Plugin
Productivity monitoring	Optional	Enable and configure the display to work with an Enalta display to record workflow.	Chapter 19, The Productivity Monitoring Plugin

Viewing the currently installed plugins

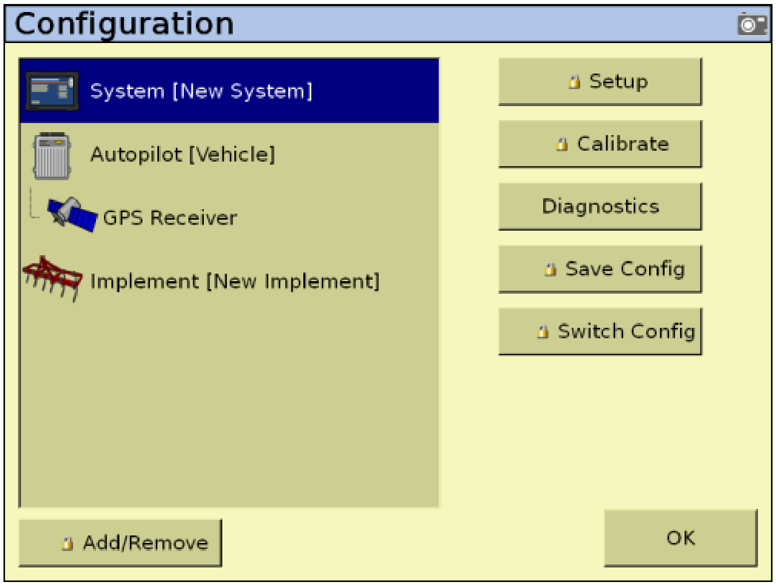
To view the active plugins, do the following:

1. From the Home screen, tap  :



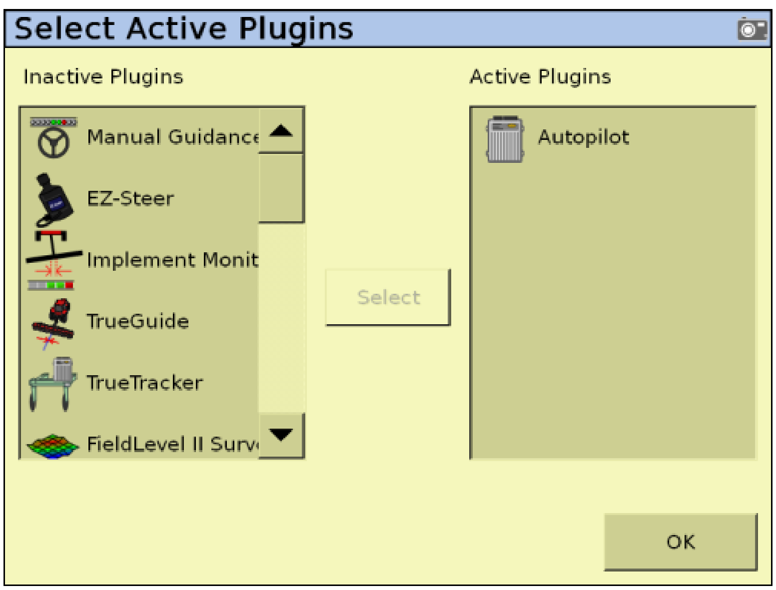
2. From the *Current Configurations* screen, tap **Configure**.

The *Configuration* screen appears, with the currently installed plugins listed on the left of the screen:



Adding or removing a plugin

1. On the *Configuration* screen, tap **Add/Remove plugin**:



2. If necessary, enter the Administration password (see Password access, page 81).

   In the *Select Active Plugins* screen, you will see:

   – the available, but not yet installed, plugins are in the *Inactive Plugins* list on the left.

– the currently installed plugins are in the *Active Plugins* list on the right.

3. Do one of the following:

   – To install a plugin from the *Inactive Plugins* list, tap it and then tap **Add >**. The plugin moves to the *Active Plugins* list.

   – To remove a currently installed plugin from the *Active Plugins* list, tap it and then tap **< Remove**. The plugin moves to the *Inactive Plugins* list.

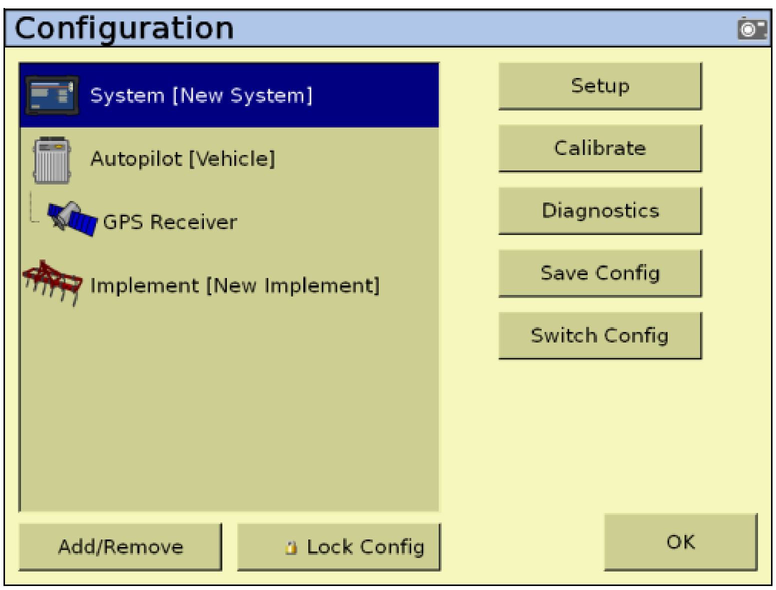
4. Tap **OK** to return to the *Configuration* screen.

Configuring a plugin

Each plugin requires a different configuration. For a detailed description of how to configure each one, see the appropriate chapter later in this manual.

In general:

- each plugin has several setup screens. To access the screens, tap the plugin and then tap **Setup**, **Calibrate**, or **Diagnostics**:



- most of the plugins add additional features to the main guidance screen.

Entering the password to activate a plugin

To activate some plugins, you must enter the activation password. If you do not have an activation password, contact your local Trimble reseller.

You can activate a plugin through a text file, see below, or manually, see page 196.

Option 1. Activating automatically through a text file

***Note –** This method of activating the system is faster than the manual method.*

When you purchase the TrueTracker system, the FieldLevel II system, or a variable rate system, your local Trimble reseller provides you with a text file containing a password.

1. Insert the USB memory stick from the FM-1000 integrated display into a card reader that is attached to an office computer.
2. Rename the text file; delete the section of the name following the password number. For example:

   Password 4850576341 FM-1000 2DGPSto2GLONASS.TXT

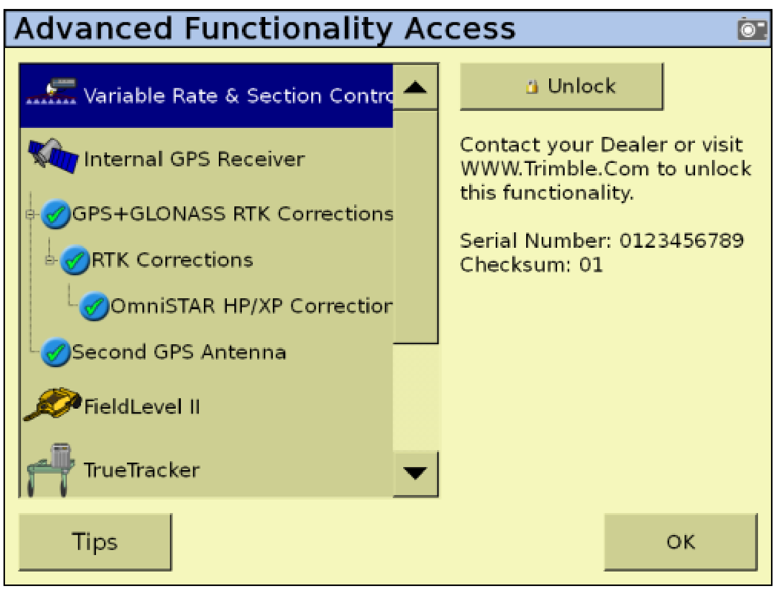
   becomes

   Password 4850576341.TXT
3. Copy the password text file from the office computer into the *\AgGPS\Firmware* folder on the memory stick.

   When you next insert the USB memory stick in the display and turn on the display, the plugin is automatically activated.

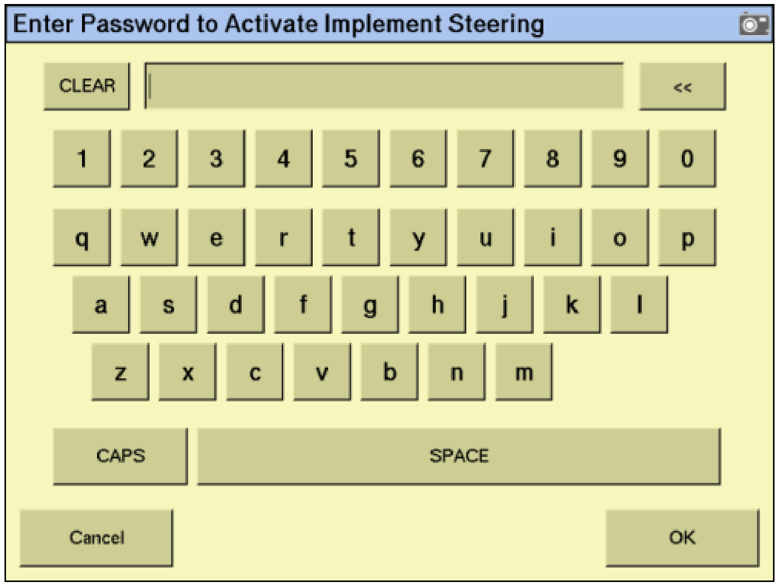
Option 2. Activating manually through the display

1. Turn on the display and then tap **Unlocks** in the Home screen:



***Note –** The Advanced Functionality Access screen features a **Tips** button that when selected provides more information about the unlock features of the FM-1000 integrated display.*

2. Tap the icon for the plugin that you want to activate and then tap **Unlock**:



3. In the screen that appears, enter the activation password that your local Trimble reseller provided and then tap **OK**:

   – If you enter a correct password, an Enabled message appears.

   The plugin is now activated.

   – If you enter an invalid password, an error message appears. Enter the password again. If it still does not work, contact your local Trimble reseller.

CHAPTER

9

The FieldLevel II Plugins

In this chapter:

- FieldLevel Survey/design plugin
- FieldLevel II plugin
- Tandem or dual leveling plugin

The FM-1000 integrated display has three FieldLevel II plugins:

- FieldLevel Survey/Design
- FieldLevel II
- Tandem/Dual

This chapter describes the function of each plugin, followed by a detailed description of how to configure and use the FieldLevel II plugins to create and manipulate field surveys.

FieldLevel Survey/design plugin

Traditionally, farmers level their fields for uniform drainage. The consistent water flow over the crops improves crop yields and crop consistency, which improves profits.

Description

The FieldLevel system is designed in three parts:

- The FieldLevel Survey/Design plugin enables you to use a high-accuracy GPS receiver on the leveling implement to create a topographic ***survey*** of the layout of your field. The three-dimensional data shows the surface topography of the land.

Note *– If you are working in a field that has already been leveled, you may not need to perform a survey and you can go straight to leveling with the FieldLevel II system.*

  Once you complete the survey, you can use it to ***design*** the optimum drainage slope that can be graded with minimal dirt movement.

- After you create a survey of the field and a design for how to modify it, you can use the FieldLevel II plugin to control a land-leveling implement on your vehicle and to adjust the land to an optimal slope. The FieldLevel II system uses a high-accuracy GPS receiver with an antenna mounted on the implement blade to measure and control its elevation. The FieldLevel II design defines the three-dimensional height for the field and controls how the implement reshapes the ground. The FieldLevel II system automatically raises and lowers the blade on the implement to match the design height anywhere in the field. The color cut/fill map, simple on-screen adjustments, and automatic blade control makes leveling easy.
- For improved productivity when leveling a field, the FieldLevel II system supports tandem or dual scraper implements.

  With a tandem system, the second scraper is also controlled by GPS, which means that you can work in areas requiring cuts, and fill two scraper buckets before you have to empty the scrapers.

  With a dual system, an antenna on each side of the scraper controls two independent cylinders. This creates a more accurate surface by controlling the height of both ends of the scraper.

Terminology

A ***cut*** is a point on the field where dirt needs to be removed. A cut occurs when the existing field is higher than the proposed field surface.

A ***fill*** is a point on the field where dirt must be added. A fill occurs when the existing field is lower than the proposed field surface.

A ***neutral*** is a point on the field where the existing and proposed elevations are the same. No dirt needs to be moved at this location.

Benefits of the FieldLevel II system

The FieldLevel II system enables you to:

- Conserve precious water resources.
- Reduce erosion and conserve topsoil.
- Perform touch-up leveling each year, to avoid expensive land leveling services.
- Help control the water table using FieldLevel II drainage features.
- Use RTK GPS technology, which has a significantly larger operating range than a laser, and no vertical limit.
- Work with your existing *Ag*GPS guidance products to manage your fields with one collective system. For example, you can connect the Autopilot system to the FM-1000 integrated display at the same time as the FieldLevel implement.

Requirements of the FieldLevel II system

The FieldLevel II system requires:

- An FM-1000 integrated display, with or without the Autopilot system.
- A platform kit to suit your vehicle and valve type (P/N 55045-xx).
- An unlock code for the FM-1000 integrated display field leveling functionality.
- A leveling or drainage implement.

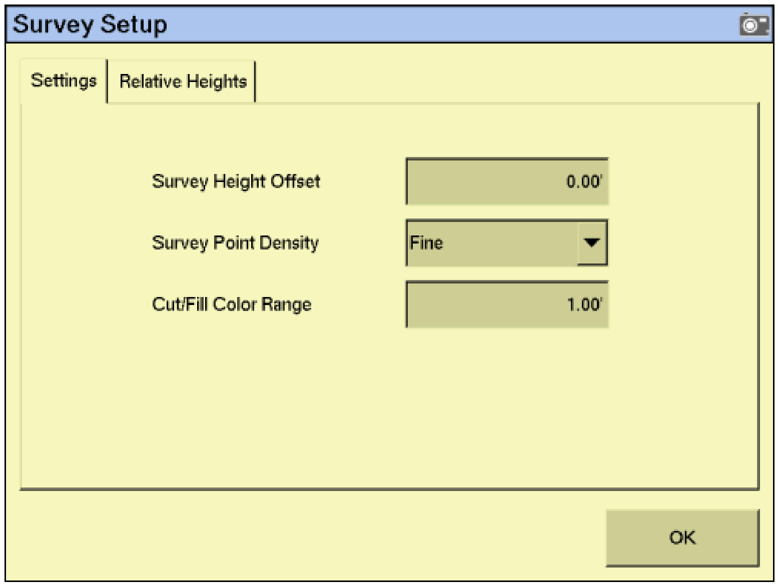
Installation

For installation instructions, refer to the *FieldLevel II System Installation Instructions* that are specific to your vehicle.

Configuration

Install the FieldLevel Survey/Design plugin (for more information, see Adding or removing a plugin, page 194). To configure the plugin:

1. From the *Configuration* screen, select the FieldLevel Survey/Design plugin and then tap **Setup**:



2. Set the *Survey Height Offset*. This value represents the difference between the height of the blade when surveying, and the height of the blade when moving dirt. To measure this value, park the implement on a flat surface and raise the blade up to its highest limit and then measure the distance from the bottom of the blade to the surface of the ground. The *Survey Height Offset* will be applied to all surveys to avoid the need to re-bench between *Survey* mode and moving dirt.

3. Set the survey point density from the *Survey Point Density* drop-down menu. When you create a survey of a field, this setting determines the distance between the collected survey mapping points. The approximate distances between points are:

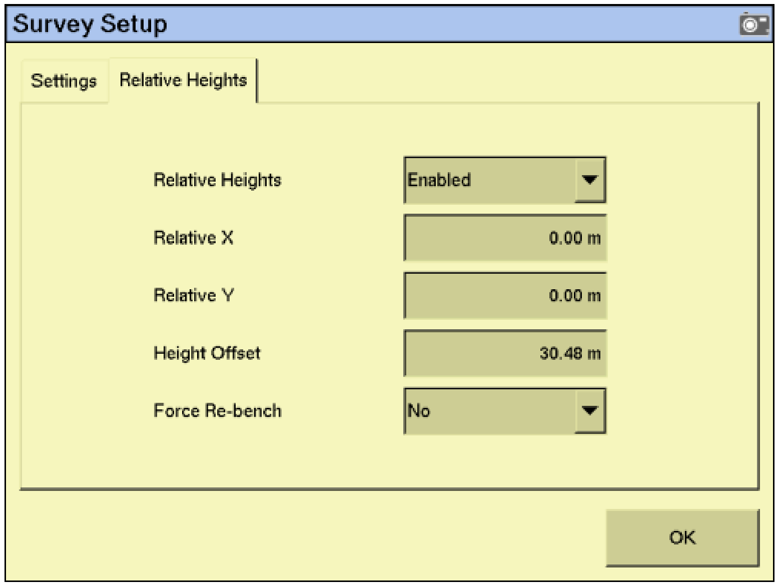
Setting	Distance
Coarse	7.8 m (25 ft)
Medium	3 m (10 ft)
Fine	1.5 m (5 ft)

4. Set the *Cut/fill Color Range*.

   The Cut/fill color range defines the vertical range in which the colors are spread over the cut/fill map. The cut/fill map appears only after you have surveyed the field and defined a design plane: The range is displayed from the highest cut value to the highest fill value. Example: If your highest cut value is 1 foot and your highest fill value is 1 foot, and you set your Cut/fill color range to 2 feet,

then the colors will be spread evenly across your cut/fill map. If you change the cut/fill color range to 1 foot then the colors will become more focused around the neutral area, providing more detail closer to the grade.

5. Select the *Relative Heights* tab:



6. Select *Enable* from the *Relative Heights* drop-down list.

   By default, coordinates are recorded relative to the master benchmark. Setting the relative positions establishes the coordinates of the master benchmark when it is set. These coordinates are then used for field leveling and topographic mapping every time the field is opened. You can set the relative position using these values:

   – the X-axis coordinate (Relative X)

   – the Y-axis coordinate (Relative Y)

   – the height (Height Offset)

7. Enter the appropriate offset in each field and then tap **OK** to return to the *Survey Setup* screen.

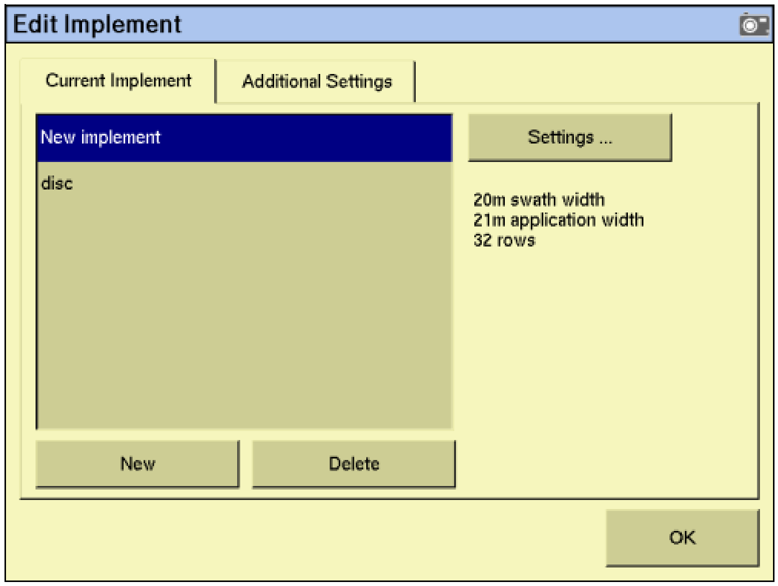
Tip – To view relative offset values on the Run screen, set the offsets as status text items on the slide-out tab.

8. Select whether or not the system will force you to rebench each time that you reload the field.

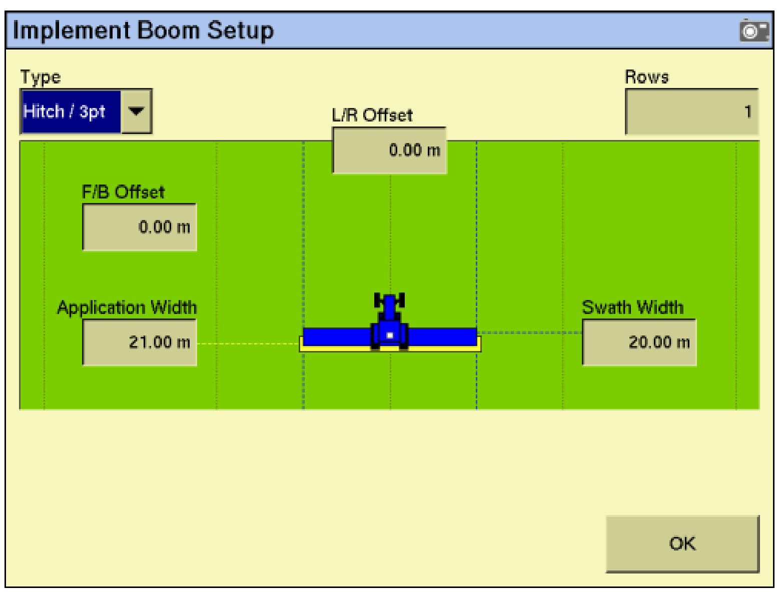
***Note** – If you configure the **Force Rebench** setting to **No**, the RTK base station must be placed in **exactly** the same position for the field to be correct.*

Configuring the implement for leveling

1. From the *Configuration* screen, select Implement and then tap **Setup**:



2. Do one of the following:
   - Tap **New** and then enter a new implement name.
   - Select an existing implement from the list.
3. Tap **Settings**:



4. Enter the details of the leveling implement:
   a. Enter the appropriate implement width and offsets.

– For a multiplane survey, set the *Swath Width* field to the width that you will use for collecting interior points.

– When you are not using FieldLevel GPS, set the front/back offset (F/B Offset) to 0.

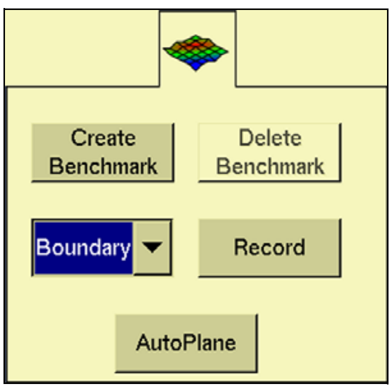
b. In the *Rows* field, enter **1**.

5. Tap **OK**.

Operating the FieldLevel Survey/Design plugin

Run screen

When the FieldLevel Survey/Design plugin is installed, the following tab appears on the main guidance screen (the Run screen):



Creating a survey

Benchmarks

Before you can create a survey, you must set a ***benchmark***—a point at a known location. When you are leveling, you can use benchmarks to do two things:

- Return to a point in the field with known coordinates to re-calibrate your exact position. This may include setting the bucket on the ground or on a solid surface that will not be disturbed while you perform field leveling.
- Move the design up or down to match the field surface at that point.

A benchmark appears on the screen as follows:

View	Shown as
Plan	A red circle
Perspective	A red flag in a red circle

The first benchmark you create on a field is called the ***master benchmark***. Field coordinates are calculated from this point. Subsequent benchmarks are called ***benchmarks***.

Note *– You can choose for coordinates to be recorded with X, Y, and Height offsets from the master benchmark position. See* *Configuration, page 202*.

Note *– You do not need to drive over a benchmark to be able to delete it.*

Creating a benchmark

1. Place the GPS antenna in a known, repeatable location that will not change throughout the leveling of a field.

Tip – Mark this location with flags or some other marker so that you can return to the exact spot.

2. Stop the vehicle.
3. Tap **Bench** on the *FieldLevel Survey/Design* tab.

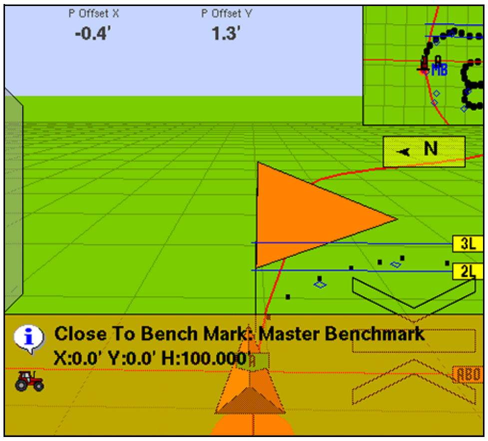
Note *– If the FieldLevel II plugin is installed, you can tap* ***Bench*** *on that instead. Both* ***Bench*** *buttons have the same effect.*

A countdown timer runs for 30 seconds and then the system creates the benchmark. To stop the averaging during the countdown, tap **Bench** again.

Note *– If you are within the circle around an existing benchmark, a new mark is not created.*

Rebenching

When you are within the circle around an existing benchmark, the following message appears on the Run screen:



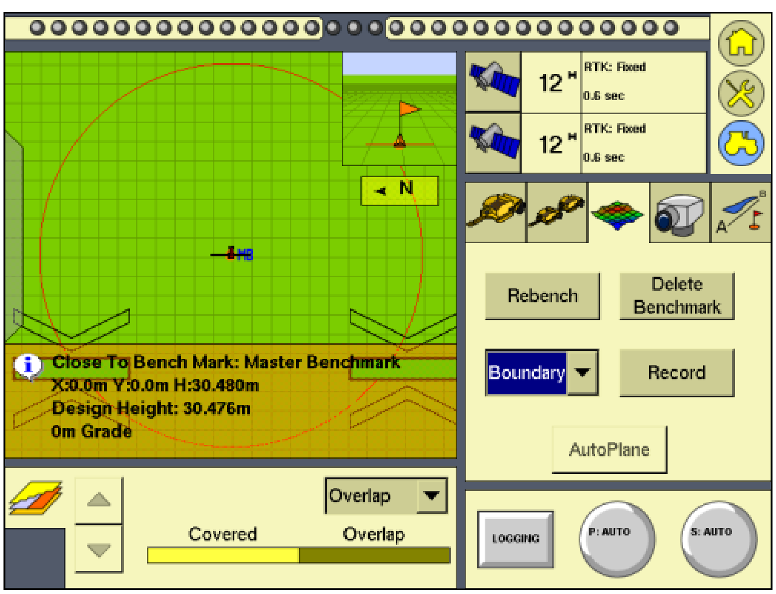
If you tap either of the **Rebench** buttons when the receiver is within the circular radius of a benchmark, the receiver is calibrated over the existing benchmark.

Re-establishing a benchmark

In the FieldLevel II configuration, under the *Relative Heights* tab, there is an option to *Force Re-Bench*. If you plan to use the same base receiver setup each time you use this survey data, you can set the option to *No*.

However, if you plan to shift the location of the base, set this option to *Yes*.

If you open a field that has an existing master benchmark and have selected *Force Rebench*, a large red circle is shown for 100 m (300 ft) around the master benchmark flag:



This indicates that you need to rebench over the master benchmark location to ensure that the design is aligned with the previous position.

You must be within this circle before you can re-establish the master benchmark. To ensure that the design is properly aligned:

1. Return exactly to the master benchmark location that you marked on the ground (for example, with flags, see Creating a benchmark, page 206), regardless of where your current onscreen position appears to be.
2. Re-establish the benchmark.

This process accommodates RTK base station setup differences from the last time the field was open.

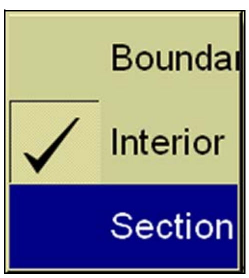
Collecting field data

After you create the benchmark(s), collect field layout data.

You can define three types of data:

Item	Description
Boundary	The outside of the field
Interior	Points on the inside of the boundary
Section	Can be used to divide the field into smaller sections

To define an item, select it from the list on the tab and then tap **Record**:



To stop recording, tap **Record** again.

Defining the boundary

Define a boundary to establish the confines of your field. Drive around the boundary, while you record the shape.

Defining interior points

The boundary is defined on the screen by a single red line. The current position is strung back to the start point of the boundary until you finish recording, so the boundary is always a closed loop.

After you survey the boundary of the field, select *Interior* from the list and then tap **Record**. As you drive, the system records interior points.

To complete a full survey, create guidance lines and then drive over all of the interior of the field boundary, while the system records interior points.

Defining a section

After you define a boundary, you can define sections to split the field into parts. This enables you to create a design for just that section, rather than the whole field.

There are two ways to define a section:

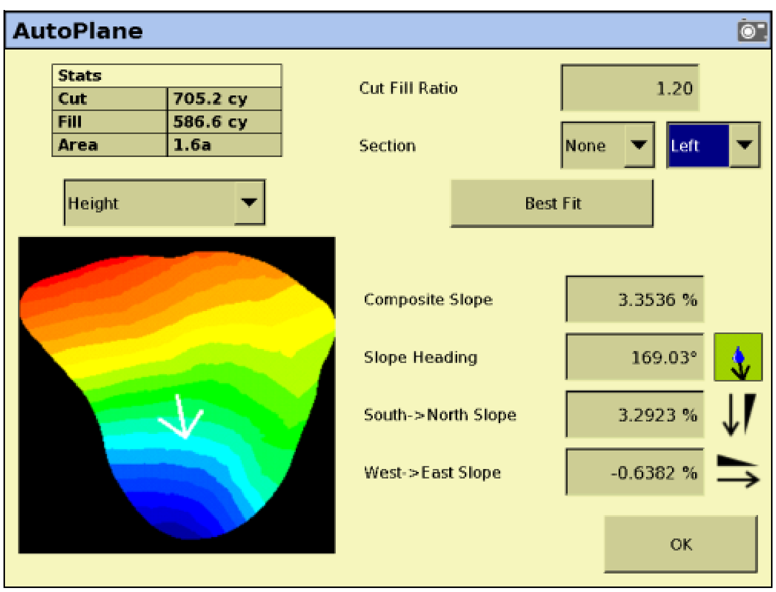
- Begin recording the section line outside the boundary. Drive through the field to define the section line and then cross outside the boundary again. The section is defined.
- Record a section line inside the boundary. The ends of the line will extend to meet the boundary.

For example, sections can be useful after you finish working on the field for the day. Define the area that you completed as a section; when you return to the field, you can level the remaining area to a second best-fit plane. See Operating the FieldLevel II plugin, page 220.

Field design

Once you define the field points, the **AutoPlane** button becomes available.

To create a design for the field, tap the button. The field points are processed and then the *AutoPlane* screen appears:



This screen shows field information and enables you to create the design for your field. The AutoPlane functionality uses the topographic survey of your field to estimate the field surface elevations. Once completed, you can establish a design either by manually editing the slopes or by using the display to calculate a best-fit plane. The best-fit

calculation optimizes the height and slopes of a design plane to minimize the amount of dirt that has to be moved. Once a design is completed, and before you exit the AutoPlane design screen, select the topographic height map or the cut/fill color theme to transfer it to the Run screen with the design.

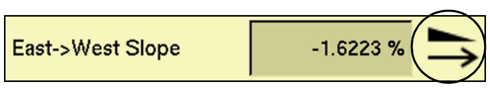
Options on the screen

Item	Description
Cut/Fill Ratio	When you move dirt, compaction or expansion can change the volume that it covers. The Cut/Fill Ratio is the amount of cut dirt that equals one volume of fill dirt. For example, the default *Cut/Fill Ratio* is 1.20. This means you lose 20% of your cut yards to compaction when you put the cut yards back down in the fill areas.
Section	If you set up sections when you defined the field, you can select one from the list.
Left/Right list	The section to the left of the section line, or the section to the right of the section line.

The design slope values show the angles and heading of the slope:

Item	Description
North -> South Slope	The angle of the design slope from North to South.
East -> West Slope	The angle of the design slope from East to West.
Composite Slope	The true angle of fall of the design. This is the angle of the slope when the two angles above are combined.
Slope Heading	The heading direction of the slope, when the two slopes are combined.

The icon beside each slope option shows the direction of the slope:



Because this is a negative slope, it drops from East to West.

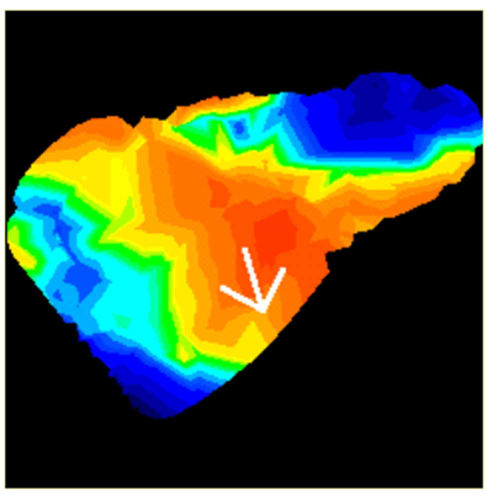
The *Stats* table at the top-left of the screen shows field information:

Item	Description
Cut	The volume of dirt that must be cut for the current design.
Fill	The volume of dirt that must be added for the current design. ***Note –*** *If the Cut and Fill values are the same, you will only be moving dirt. The volumes will balance out.* The system includes the Cut/Fill Ratio when configuring these amounts. See page 210.
Area	The area of the field inside the boundary.

The image of the field on the left of the screen can show one of two things:

- When the **Height** button is selected, the image shows the topographical height of the field:

- When the **Cut/Fill** button is selected, the image shows where dirt needs to be removed and where it needs to be added:
  - Areas that require dirt to be cut are shaded red.
  - Areas that require dirt to be filled are shaded blue.
  - Neutral areas that do not need adjusting are shaded green.



Creating a design

To create a design for the optimum slope for your field that requires the minimum amount of dirt to be moved:

1. Enter the *Cut/Fill Ratio*.
2. In the *Section* list, do one of the following:
   - Select the section to level.
   - Select *None* to level the whole field.
3. Tap **Best Fit**.

The system uses the interior points that you collected to calculate the optimum slope of the field. The design information appears in the design slope options and the *Stats* table. An arrow appears on the image of the field to show the direction of fall.

If necessary, you can manually adjust the angle of the slope. However, this may require a greater amount of dirt to be moved, because the original design was the optimum.

Saving the new design

Tap **OK** to close the *AutoPlane* screen. The new design is saved as the default plane for this field. When the field is opened, the design loads but the color theme is not saved. To re-establish the color theme, tap **AutoPlane** and then select **Height** or **Cut/Fill**.

Reloading a field

When you create a design for a field (for example, a target leveling plane), the design is saved in the */field/* folder.

The design files are associated with the field, so if you close the field and then open it again, the design reloads with the field.

With RTK GPS, the position of the RTK base station is important to the heights used when the field was previously open. If the base station is not accurately positioned in the same physical location, you must reestablish the design over an existing benchmark to reestablish the height.

FieldLevel II plugin

MultiPlane designs

The FieldLevel II system supports external leveling designs from MultiPlane design software. MultiPlane software can run a wide range of "what if" scenarios, enabling you to create complex designs with multiple field sections. You can export these design control files and then load them into the FieldLevel II system to shape the field surface based on the work in the office.

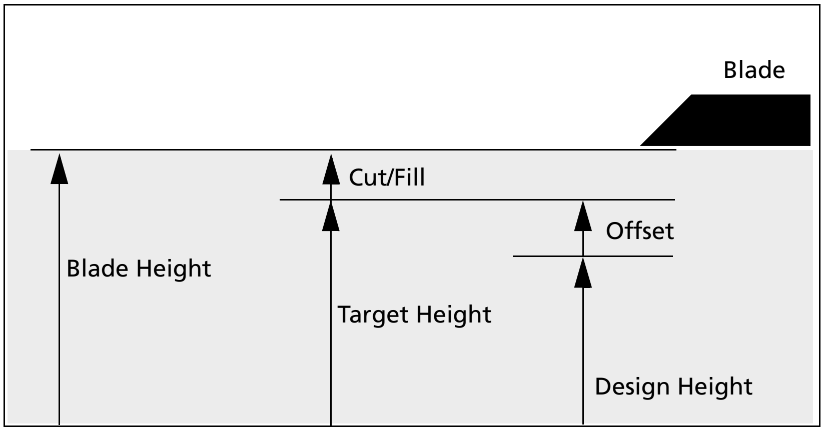
Leveling models

In addition to AutoPlane and MultiPlane design support, the FieldLevel II system has five additional leveling models:

- Point and Slope – The system levels at a consistent upward or downward slope, regardless of the vehicle's direction. This can be useful for installing tile and field drainage.
- Autoslope – You define a section line and a set of constraints for the system to use to design either a tile or surface ditch profile. The system will then install tile or cut a surface ditch to that design.
- Flat plane (laser) – Use this leveling model to level a field that has previously been measured with a laser. The FieldLevel II GPS system will correct the design heights to a plane surface to match your previous laser system.
- Flat plane (GPS) – Use this model to level a field using the FieldLevel II GPS system. No corrections will be made to a flat plane, so the surface will be curved to match the surface of the Earth. This is the most accurate model to use so that water sits at an equal depth across a field.
- Contour – The system guides you around a contour. The system indicates whether to drive up or down to maintain your current level. This is designed for marking rice levees.

Terminology

The FieldLevel II system uses the following terms:



Item	Description
Blade Height	The current height of the blade.
Design Height	The height at the current location determined by the design plane.
Offset	The difference between Design Height and Target Height. Using the offset buttons creates a plane that is parallel to the original design.
Target Height	The height on the target plane that the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the height indicator arrow turns green.
Cut/Fill	The difference between the Blade Height and the Target Height: • When Cut is displayed, the current ground is above the target. The height indicator arrow turns red and points down, which means that the blade needs to move down to reach the Target Height. • When Fill is displayed, the current ground is below the target. The height indicator arrow turns red and points up, which means that the blade needs to move up to reach the Target Height.

Configuring the FieldLevel II plugin

***Note** – Before you can configure the system, it must be professionally installed. For more information, contact your local reseller.*

There are five steps to complete:

- Step 1. Configuring the implement, page 215
- Step 2. Configuring the leveling model, page 215
- Step 3. Calibrating the FieldLevel valve module, page 219
- Step 4. Configuring the FieldLevel GPS receiver, page 220

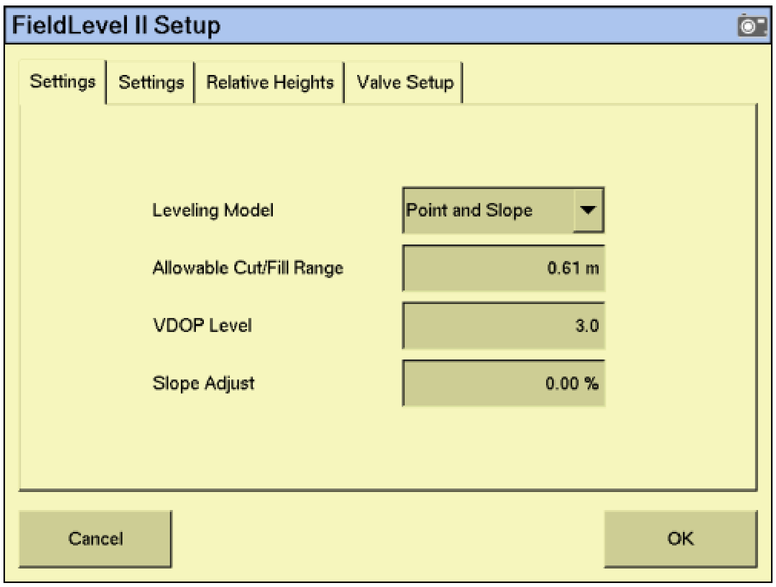
Step 1. Configuring the implement

If you have not already configured the implement, see Configuring the implement for leveling, page 204.

Step 2. Configuring the leveling model

Install the FieldLevel II plugin (for more information, see Adding or removing a plugin, page 194).

1. From the *Configuration* screen, select the FieldLevel II plugin and then tap **Setup**:



2. Select the leveling model from the drop-down list:

Leveling model	Description
Point and Slope	Creates consistently sloped tile or surface drainage. From the starting point, the vehicle levels at a constant slope, regardless of its direction. See Slope adjust for Point and Slope leveling, page 216.
Autoslope	Creates a tile or surface drainage design at an optimal depth within a set of constraints. The slope will not be constant, providing the most efficient tile or ditch design. See Driving in Autoslope mode, page 230
Flat Plane (laser)	Levels the field to a design plane. The plane can be configured in the onboard software using benchmarks and slopes, or by creating a plane of best-fit over a surveyed surface (Autoslope). It uses a high-accuracy GPS receiver mounted on the leveling implement. However, the design heights are corrected to a plane surface to match your old laser leveled fields. See Configuring settings for all leveling models, page 217.

Leveling model	Description
Flat Plane (GPS)	Levels the field to a design plane. The plane can be configured in the software using benchmarks and slopes, or by creating a plane of best-fit over a surveyed surface (Autoslope). It uses a high-accuracy GPS receiver mounted on the leveling implement. See Configuring settings for all leveling models, page 217.
Multiplane design	Uses more complex surface designs imported from the MultiPlane design software. See Working with MultiPlane designs, page 227
Contour	Uses the FM-1000 integrated display virtual lightbar, or an LB25 external lightbar to guide the vehicle along contours to keep the vehicle at the same elevation. This can be used for levee marking and applications that require guidance to elevations. See Configuring settings for all leveling models, page 217.

The FieldLevel II plugin *Setup* screen has five tabs: *Settings, Blade Settings, Relative Heights*, *Valve Setup*, and *Height filter*.

The *Settings* tab is the same for all leveling models, except for Point and Slope, which includes an extra field for *Slope Adjust*. The other four tabs are the same regardless of which leveling model you choose, and are described in the following sections.

Slope adjust for Point and Slope leveling

When you select Point and Slope leveling, the *Slope Adjust* setting appears in the first settings tab of the FieldLevel II *Setup* screen.

Item	Description
Slope Adjust	The *Slope Adjust* field controls the amount that the gradient changes each time you tap the up arrow or the down arrow on the *Level* tab. For example, if the leveling gradient is set to -3%, and the *Slope Adjust* field is set to 2%, when you tap the down arrow on the *Level* tab, the leveling gradient increases to -5%.

Configuring settings for all leveling models

Item	Description
Allowable Cut/Fill Range	Select the *Allowable Cut/Fill Range* field and then enter the acceptable warning distance. When Auto mode is engaged and the blade is outside this range for more than three seconds, a warning appears.
VDOP Level	*Vertical Dilution of Precision* (VDOP) is a measure of the vertical accuracy of the GPS signal. If the VDOP reaches this value, a warning message appears. Trimble recommends a VDOP setting of less than 3.
Blade Step	Tap the *Blade Step* field and then enter the amount that you require the blade to move, each time it is “stepped” up or down by the **^** or **v** offset buttons.
Course Blade Step	Coarse mode enables you to offset the target height in large increments with a single tap, such as a 0.2' fill. Select the *Coarse Blade Step* field and then enter the amount that you require the blade to move each time it is stepped up or down in *Coarse* mode.
Antenna Height	Select the *Antenna Height* field and then enter the height of the antenna above the lower edge of the blade.
On-grade Limit	Select the *On-grade Limit* field and then enter the limit. This sets the distance the blade can move before the green blade height indicators change to thin red arrows. At twice this distance, the height indicators become thick red arrows. See Blade position indicators, page 223.
Disengage Raise	When you disable *Auto* while scraping a field, you can set a time value that will automatically raise the blade. For example, if you set 0.5s, the blade will raise for half a second when you turn off *Auto* mode.
Remote Input Auto	You can attach a remote for enabling and disabling *Auto* mode. This remote is controlled with the *Remote Input Auto* setting.

Configuring relative heights for all leveling models

By default, relative heights are enabled (meaning coordinates are recorded relative to the master benchmark). For field leveling or data collection, you can set relative offsets so that the coordinates are recorded relative to the offsets set for the master benchmark. You can set offsets in any of the following directions:

- The X-axis
- The Y-axis
- The height

The *Relative Heights* tab of the FieldLevel II *Setup* screen shows the following items:

Item	Description
Relative Heights	Select *Enabled* to use relative heights from the master benchmark. Choose *Disabled* to use GPS heights at all times.
Relative X	If relative heights are enabled, this is the X coordinate that will be applied to the master benchmark.
Relative Y	If relative heights are enabled, this is the Y coordinate that will be applied to the master benchmark.

Item	Description
Height Offset	If relative heights are enabled, this is the height value that will be applied to the master benchmark.
Force Rebench	If Force Rebench is set to Yes, and the field has been closed and opened again, the system will not let you start work until you have re-benched. Use this setting if you are using a different base station setup between work sessions. If you have a permanent base station setup that is never moved, then it is OK to not force a rebench.

Tip – To view relative offset values on the Run screen, set the offsets as status text items on the slide-out tab.

Configuring the Valve Setup for all leveling models

When you select the *Valve Setup* tab on the FieldLevel II *Setup* screen, the following items are available:

Item	Description
Valve Type	Select the *Valve Type* field and then select the type of valve that is connected.
CAN Bus	Select the port on the FM-1000 integrated display that the valve module is connected to.
Valve inverted	Leave this field as Not Inverted unless the tank and pressure hoses have been installed incorrectly on the valve. If this is the case, select Inverted to eliminate the need to reverse the hoses.

Configuring the Height Filter for all leveling models

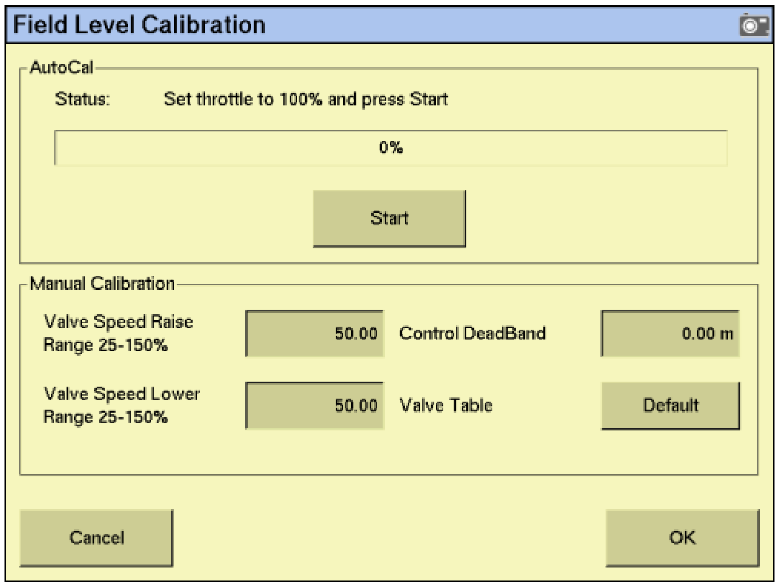
When you select the *Height Filter* tab on the FieldLevel II *Setup* screen, the following items are available in the *Filter Type* list:

Item	Description
None	Trimble recommends this setting (this is the raw GPS data used for height).
Average	The height will be averaged using the number of positions selected. This will smooth spikes in height readings but will introduce a latency into the controls.
Jump detect	This will filter out some jumps in the height readings. When selected, the following values must be entered: *Threshold* = the change in height value that will trigger the filter. *Decay Time* = once the filter is triggered, this will be the amount of time it takes to gradually resume using the raw GPS height.

Step 3. Calibrating the FieldLevel valve module

Note – *Depending on the make and manufacturer of your vehicle, the tractor computer may need to be put into a special mode. Refer to the FieldLevel II Installation Guide for your vehicle type.*

1. From the *Configuration* screen, select the FieldLevel II plugin and then tap **Calibrate**:



2. Set the vehicle throttle to 100%.
3. Tap **Start**.

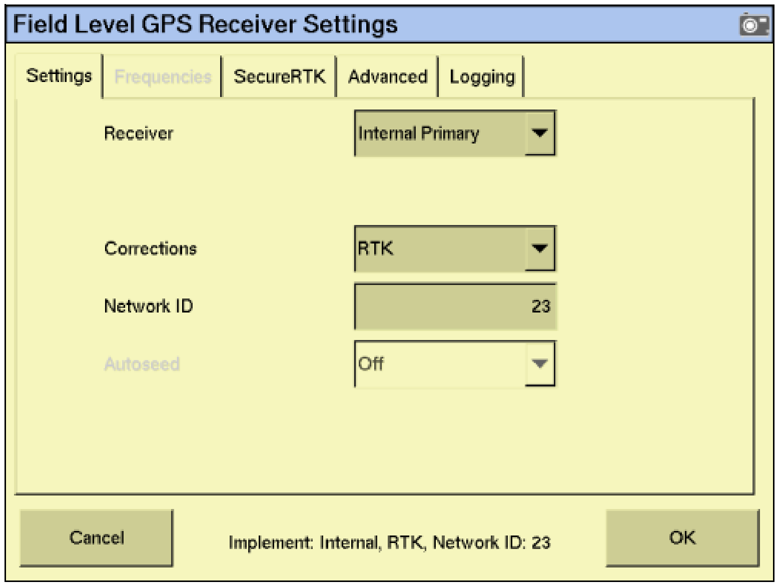
   The system performs its calibration sequence to test the speed at which the blade raises and lowers. This process takes approximately 8 – 10 minutes.

To manually calibrate the valve, enter values in the three *Manual Calibration* fields and then tap **OK**.

Step 4. Configuring the FieldLevel GPS receiver

The FieldLevel system uses its own GPS receiver to record the exact position of the leveling blade. To configure this receiver:

1. From the *Configuration* screen, select the GPS Receiver option that is associated with the FieldLevel II plugin and then tap **Setup**:



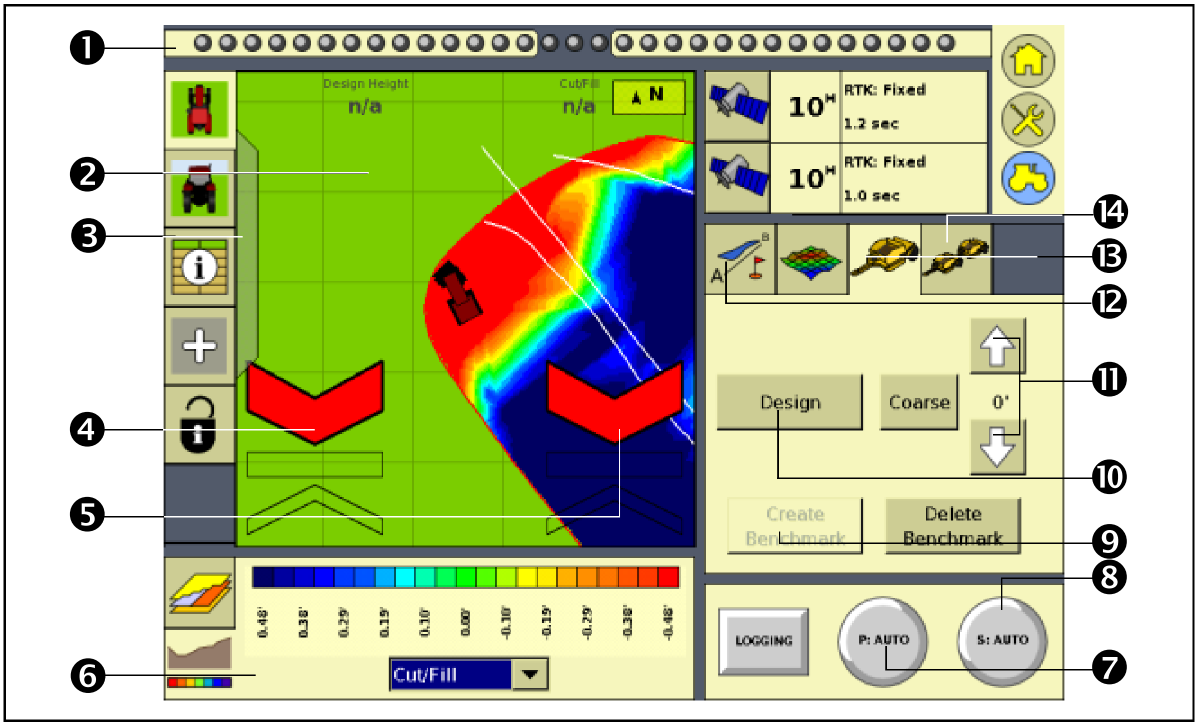
2. From the *Receiver* drop-down list, select which GPS receiver you will use for your FieldLevel system. Trimble recommends that you select *Internal Primary* when configuring the display as a stand-alone FieldLevel II system, but you can use an external GPS receiver. If you are also using the Autopilot system, Trimble recommends that you use *Internal Secondary*, as the Autopilot system will be occupying the Internal Primary receiver.
3. From the *Corrections* drop-down list, select *RTK* for all FieldLevel II applications.
4. Set the *Network ID* to the same network ID that is set in the base station receiver
5. Tap **OK**.

The FieldLevel II plugin is now configured and ready to use.

Operating the FieldLevel II plugin

Run screen

The FM-1000 integrated display's Run screen changes when the FieldLevel II plugin is installed. It can also change depending which leveling model is selected:



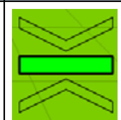
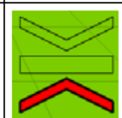
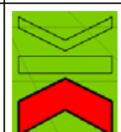
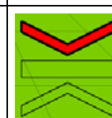
Item	Description	Description
❶	Virtual lightbar	Provides guidance with illuminated LEDs. When using the FieldLevel II Contour leveling model, the virtual lightbar can be used for levee marking. Also, in the Autoslope leveling model, it will guide you onto the design alignment when installing tile or cleaning a surface ditch.
❷	Cut/fill map	Shows the difference between the design plane and the survey. Green areas are on grade, blue areas require fill, and the red areas require cut.
❸	Status items tab	Open to view a variety of text information regarding the operation of the FM-1000 integrated display.
❹	Primary cut/fill indicator	Primary cut/fill indicator. When the blade is below grade, the up arrow is red (thin is close, thick is a long way off). When the blade is above grade and cut is required, the down arrow is red. When on grade, the center is green. See Blade position indicators, page 223.
❺	Secondary cut/fill indicator	For use with tandem and dual scrapers. For dual scrapers it is the right side. For tandems, it is the rear scraper. See Blade position indicators, page 223.
❻	Cut/fill status panel	This scale bar displays the number value assigned to each color. You can choose to display either cut/fill or height.
❼	Primary Auto	This button engages the automatics to the hydraulic valve controlling the blade. When using dual scrapers, this is the left side of the blade. When using tandem scrapers, this is the front scraper.
❽	Secondary Auto	This button engages the automatics to the hydraulic valve when using dual or tandem scrapers. When using dual scrapers, this is the right side of the blade. When using tandem scrapers, this will control the rear scraper.

Item	Description	Description
❾	Create Benchmark	You must create benchmarks that FieldLevel II operations use as a point of horizontal and vertical reference.
❿	Design button	Engage this button to design a field slope and orientation, or in the case of Autoslope, you can set the design parameters for the tile or surface ditch profile.
⓫	Blade step	Use the up and down arrows to manually adjust the grade of the scraper or tile plow blade.
⓬	FieldLevel II single control	Used when there is a single antenna on a scraper or tile plow.
⓭	FieldLevel II Survey/design control	Used for surveying boundaries, interior lines, or section lines. It is also for designing an "Autoplane" surface where you can create a best-fit plane through a surveyed field and balance the cut and fill to your requirements.
⓮	FieldLevel II dual control	Used for either a dual or tandem scraper configuration.

Blade position indicators

When you use the FM-1000 integrated display to provide guidance (for example, guiding to a contour), guidance is displayed on the virtual lightbar at the top of the screen.

When you use the display to show field leveling information, blade position indicators appear on the Run screen.

Item	Description	Example
Green bar in center	The blade is at the correct target height (it is within the *On-Grade Limit*).	
Small red arrow pointing up	The blade is beyond the *On-Grade Limit* value below the target height.	
Large red arrow pointing up	The blade is considerably below the target height (more than double the *On-Grade Limit* value).	
Small red arrow pointing down	The blade is beyond the *On-Grade Limit* value above the target height.	
Large red arrow pointing down	The blade is considerably above the target height (more than double the *On-Grade Limit* value).	

The arrow points in the direction that the blade needs to move for the blade to be on grade. The size of the up or down arrow indicates the amount of movement required.

FieldLevel status text items

Status text items describe factors in leveling models.

Note – *The FieldLevel status items all begin with P which denotes the Primary GPS receiver. If you have the Tandem/Dual plugin installed, you will also have "S" status items available which denotes Secondary.*

Item	Description
P Altitude	The current GPS altitude of the blade.
P Blade Height	The current height of the blade shown as a relative height or a GPS height depending on settings selected.
P Boot Depth	The depth of the boot when installing tiles or the depth of the blade when cleaning surface ditches (used with the Autoslope leveling model).

Item	Description
P CMR Percent	The percentage of data being successfully received from the base GPS receiver.
P Correction Age	The time since the last GPS correction was received from the GPS base station.
P Correction Type	The solution type (for example: RTK Fixed, or RTK Float, etc.)
P Cut/fill	The difference between the blade height and the target height. When *Cut* is displayed, the current ground height is above the target height, and the height adjustment indicator shows a red down arrow, which means that the blade needs to moved down to reach the target height. When *Fill* is displayed, the current ground height is below the target height.
P Design Height	The originally planned or designed height at the current location.
P Design Slope	When using the Autoslope leveling model, this displays the design slope with respect to the current location along the section line.
P Distance Travelled	For use with Point to Slope mode, this is the distance traveled since Auto mode was enabled.
P East	The difference in the East component from the *Local Tangent Plane* (LTP).
P GPS Status	The solution type (for example: RTK Fixed, or RTK Float, etc.)
P H Error	The current estimate of the error in the horizontal component.
P HDOP	The horizontal dilution of position.
P Heading	The current direction that the vehicle is heading in.
P Latitude	The latitude as recorded by the GPS receiver.
P Longitude	The longitude as recorded by the GPS receiver.
P Network ID	The network ID that the GPS receiver is set to, which needs to be the same as the base receiver network ID.
P North	The difference in the North component from the *Local Tangent Plane* (LTP).
P Offset	The relative offset in the vertical component.
P Offset X	The relative offset in the X component.
P Offset Y	The relative offset in the Y component.
P Satellites	The number of satellites in the GPS/GLONASS solution.
P Speed	The current speed of the vehicle.
P Target Height	The height the blade will attempt to reach. This is the design height ± the offset. When the blade reaches the target height, the arrows turn green.
P Up	The difference in the up component from the Local Tangent Plane (LTP).
P VDOP	The vertical dilution of precision.
P Vertical Error Estimate	The current estimate of error in the height calculated by the FieldLevel GPS receiver.

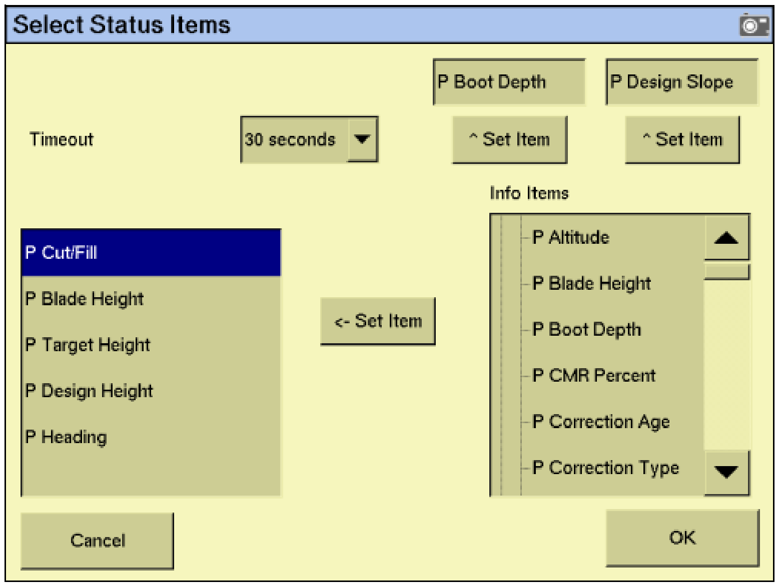
These status text items can be set to appear permanently at the top of the screen or on a slide-out tab. The following items can also be viewed from the Run screen:

- FieldLevel GPS status
- FieldLevel Number of satellites

- FieldLevel correction age

You can either choose the individual status text items that are on the slide-out tab, or you can use the default selections:

1. From the *Configuration* screen, select the System option and then tap **Setup**. The *Display Setup* screen appears.
2. Select *Status Items* and then tap **Setup**:



3. To manually add a status text item to the tab:
   a. From the list on the left, select the position to fill.
   b. From the *Info Items* list, select the status text item to be added.
   c. Tap **<- Set Item**.

***Note** – From the Timeout menu, select Never to prevent the Status tab from automatically retracting. The Status tab will then only retract when tapped.*

Reloading a field

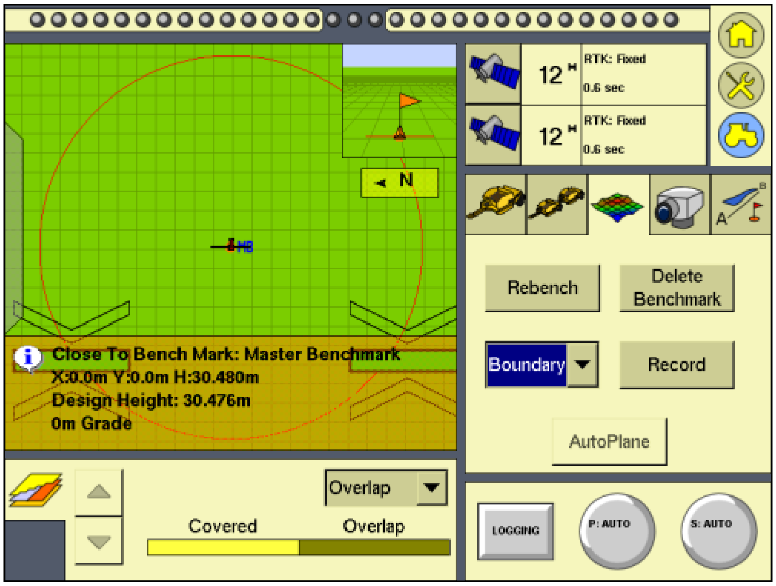
When you create a design for a field (for example, a target leveling plane), the design is saved in the */field/* directory.

The design files are associated with the field, so if you close the field and then open it again, the design reloads with the field.

With RTK GPS, the position of the RTK base station is important to the heights used when the field was previously open. If the base station is not accurately positioned in the same physical location, you must reestablish the design over an existing benchmark to reestablish the height.

Re-establishing a benchmark

If you open a field that has an existing master benchmark, a large red circle is shown for 100 m (300 ft) around the master benchmark flag:



This indicates that you need to rebench over the master benchmark location to ensure that the design is aligned with the previous position.

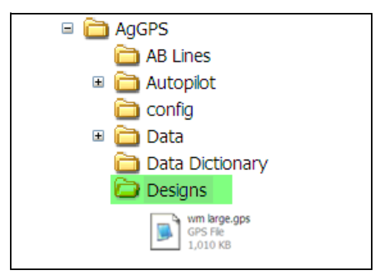
You must be within this circle before you are allowed to re-establish the master benchmark. To ensure that the design is properly aligned:

1. Return exactly to the master benchmark location that you marked on the ground (for example, with flags, see Benchmarks, page 205), regardless of where your current on-screen position appears to be.
2. Re-establish the benchmark.

This process is designed to accommodate RTK base station setup differences from the last time the field was open.

Importing control files from the Multiplane software

Once you finish manipulating a topographic survey file in *MultiPlane*, you can export a control file (*.GPS) for use with the FieldLevel II system. Copy the design control file into the *\AgGPS\Designs* folder on a USB memory stick.

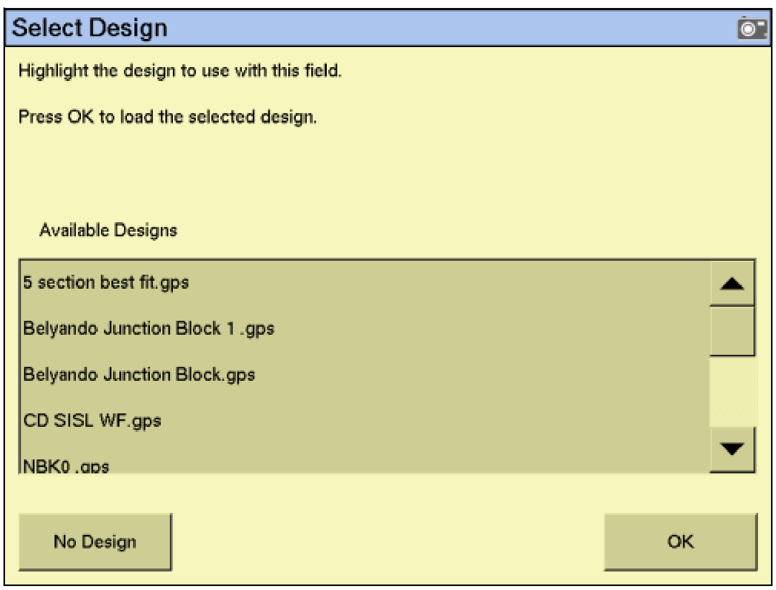


If the USB memory stick has not yet been used with the FM-1000 integrated display, the *\AgGPS\Designs* folder will not exist. To create the directory on the USB memory stick:

1. Insert the USB memory stick into the back of the FM-1000 integrated display.
2. From the *Configuration* screen, select *System* and then tap **Setup**. The *System Setup* screen appears.
3. From the list of system settings on the left, select *Data Files* and then tap **Manage**. The *Data Files* management screen appears.
4. From the list on the right (directories that already exist in the display), select the *Designs* directory and then tap **Copy**. The directory is copied to the USB memory stick.
5. When the Copy completed message appears, tap **OK**. The copied directory appears in the list of directories on the left side of the *Data Files* screen.

Working with MultiPlane designs

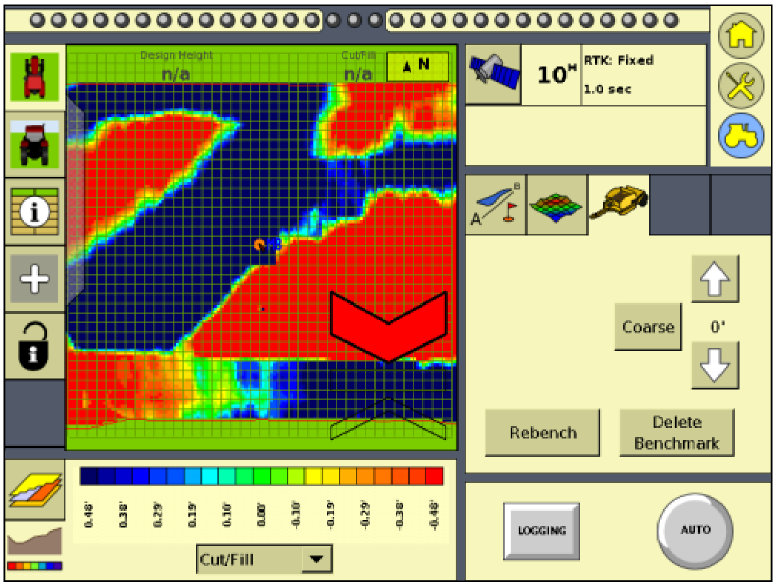
When the leveling model is set to *Multiplane Design* and the FM-1000 integrated display opens a field, it scans the *\AgGPS\Designs* folder and any MultiPlane .gps control files that are close to your current position are displayed:



Select the appropriate control file and then tap **OK**.

The control file will be loaded, displaying a color cut/fill map of the field (red = cut; blue = fill).

When you use a MultiPlane design control file, the FieldLevel II system remains in Auto mode if you drive off the design, but maintains the design height it had when you left the design. If you disengage Auto mode when you are off the design, the display will not allow you to re-engage the FieldLevel II system until your position is back over the color cut/fill map.



Leveling model specific information

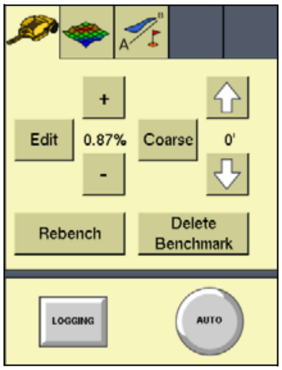
You have different leveling options, depending on the leveling mode that you selected (see Step 2. Configuring the leveling model, page 215):

For information specific to the leveling model:

- For Point and Slope mode, see below.
- For Autoslope mode, see page 230.
- For Flat Plane (Laser) mode, see page 236.
- For Flat Plane (GPS) mode, see page 236.
- For Contour mode, see page 241.

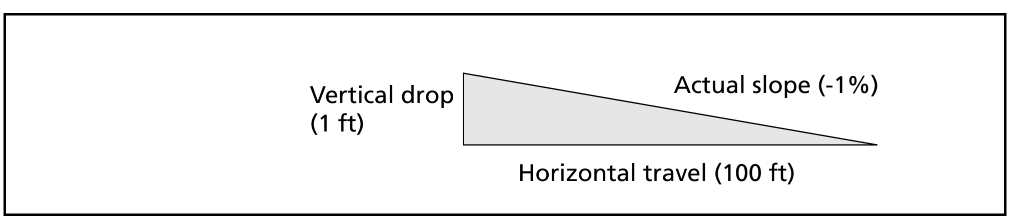
Driving in Point and Slope mode

When you drive in Point and Slope mode, the *FieldLevel II* tab appears as follows:



Tap...	To...
Edit	Edit the design slope.
+ button	Increase the design slope by the Slope Adjust amount.
- button	Decrease the design slope by the Slope Adjust amount.
Bench or Rebench	Create a benchmark, see Benchmarks, page 205. Set the Design Height equal to the Blade Height.
Delete Benchmark	Delete any benchmark on the field. *Note: You do not have to drive over a benchmark to delete it.*
Up Arrow	Raise the blade by the Blade Step amount.
Down Arrow	Lower the blade by the Blade Step amount.
Auto	Engage automatic blade height control: • starts the slope calculation • resets the height • resets the cut/fill
Coarse	Use the Up and Down arrows to change the blade height by the *Coarse Blade Step* amount. This enables you to move the blade by a large amount instead of small increments.
Logging	Log the coverage, so that you can see on the map where you have been dependent on your Implement Width. A shape file is created with cut/fill and height information

The slope is defined as the percentage vertical drop against horizontal travel. A positive slope goes upwards and a negative slope goes downward. For example, if the slope is set to -1%, the slope will drop 1 ft for every 100 ft horizontally traveled:



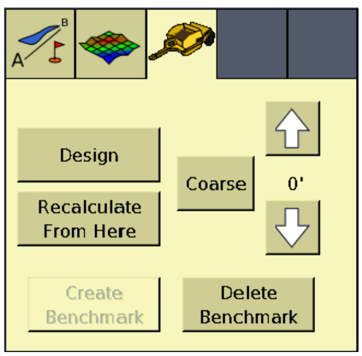
To view or change the Point and Slope gradient, tap **Edit** on the *FieldLevel II* tab. Alternatively, tap the **+** or **-** buttons to move the slope by the *Slope Adjust* amount (defined in the *FieldLevel* settings, under *Leveling model - Point and Slope/Slope Adjust*).

Driving in Autoslope mode

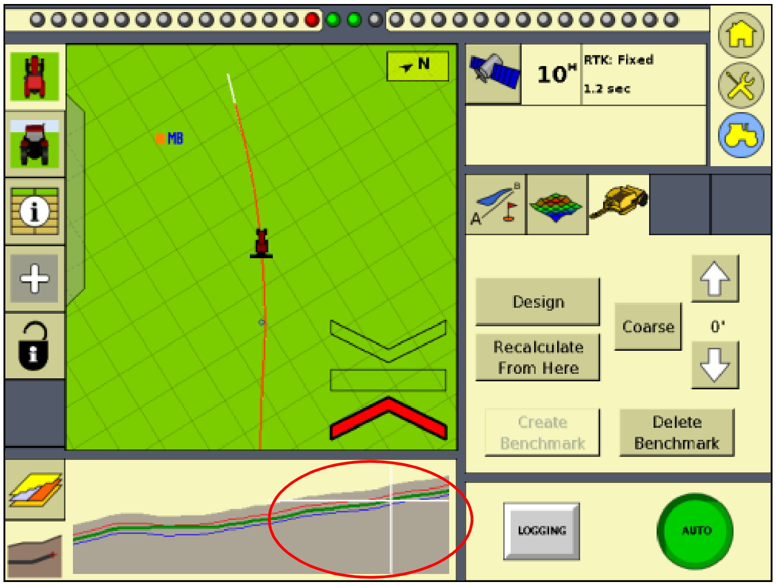
The AutoSlope leveling model can be used for both tile and ditching applications. For tile applications, the system runs on both self-propelled tile machines and pull-type plows towed behind a tractor. For ditching applications, the AutoSlope system works with any type of scraper or ditching machine supported by the FieldLevel II system.

Note *– When the system is not running in Auto mode, the virtual lightbar, or LB25 lightbar, will guide to any existing A/B line, allowing you to use manual guidance for surveying in section lines to be tiled at a constant spacing.*

When driving in Autoslope mode, the *FieldLevel II* tab appears as follows:



Tap…	To…
Design	Set the Autoslope constraints for your tile or ditch design. Finalize the design before installing the tile or cleaning the ditch. *Note: A white cross is displayed on the run screen, showing both horizontal and vertical location. See screenshot below table.*
Up arrow	Raise the tile boot or blade by the Blade Step amount.
Down arrow	Lower the tile boot or blade by the Blade Step amount.
Recalculate from here	When the tile plow encounters a rock, pull the boot up over the rock then press **Recalculate From Here**. This will modify the design to ensure that the rest of the tile run stays within the minimum slope requirement, preventing the pipe from diving down to the original design grade. *Note: This feature works only when installing tile in the direction away from the outlet point.*
Coarse	When selected, pressing the Up or Down arrows will move the blade by the *Coarse Blade Step* amount. This enables the operator to move the blade by a large amount instead of small increments.
Auto	Set Automatics to the hydraulic valve. The blade or tile boot will be driven to the design depth depending on where you are relative to the section line.
Logging	Log the coverage, so that you can see on your map where you have been dependent on your Implement Width. A shape file will also be created with cut/fill and height information.

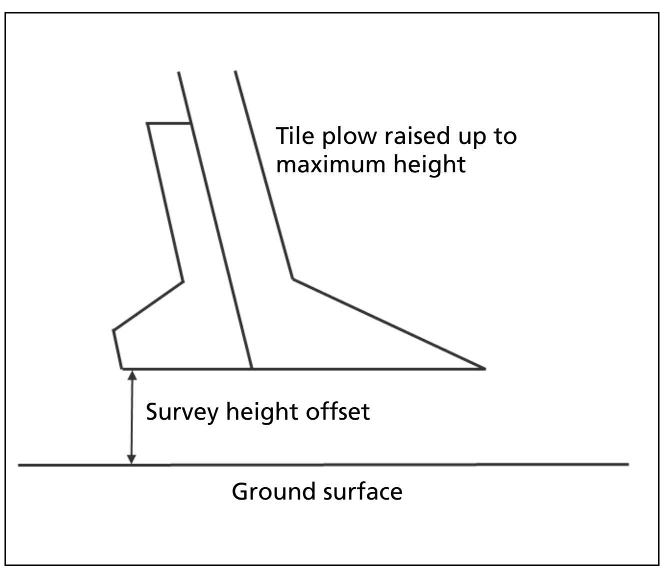


Surveying your alignment for tile or ditch

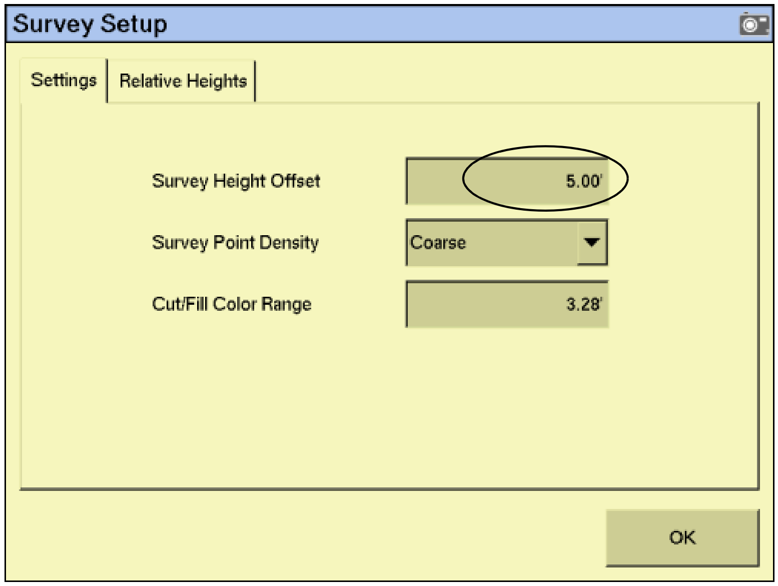
Before you begin using Autoslope, you must set the *Survey Height Offset*. This offset will be applied to the heights of your surveyed alignment, preventing the need to rebench before installing tile. This means that you can survey the alignment, and then install tile straight away.

To set the *Survey Height Offset*, do the following:

1. From the *Configuration* screen, select the FieldLevel Survey Design plugin and then tap **Setup**. The *Survey Setup* screen appears.
2. On the tile plow, raise the boot as high as it will go and measure the distance from the bottom of the tile boot to the ground:



3. Enter this value into the *Survey Height Offset* field:

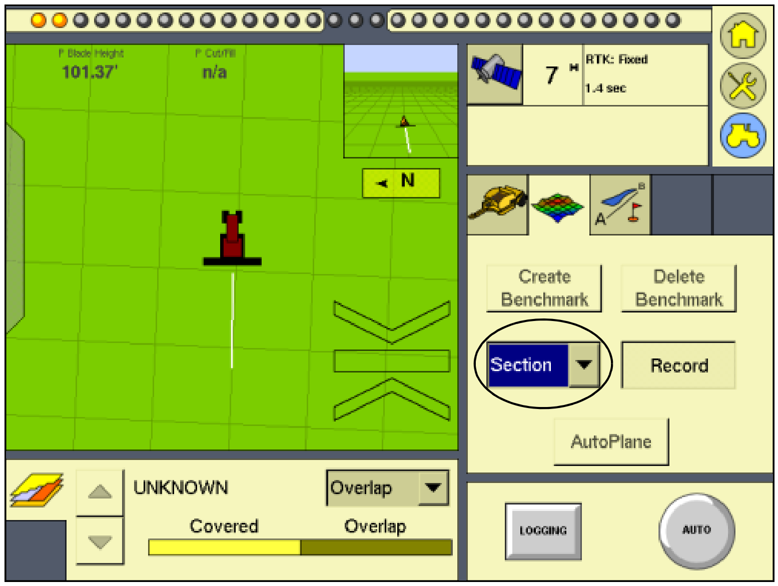


***Note** – Trimble recommends that you change the Survey Point Density from Coarse to Fine. The FieldLevel II system will then record survey points every 1.5m (5 ft) and provide a more accurate profile of the ground surface.*

4. Tap **OK**.

5. In the Run screen, drive to a point that will be untouched to use as a reference point. Measure a master benchmark and then flag this point so you can easily find it again.

6. Drive the vehicle to the start of the line where you want to install tile or clean a ditch (for the most efficient method, Trimble recommends that this is the high end of the line). Open the *Survey/Design* tab and then select *Section* from the drop-down list:



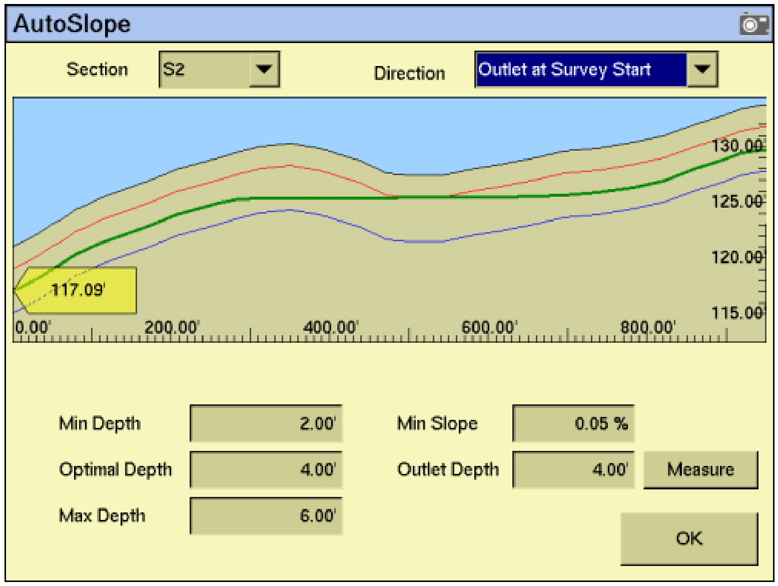
7. Tap **Record** and then drive the line all the way to the end point (for the most efficient method, Trimble recommends the end point is where the tile line is to be connected to a main or outlet). Tap **Record** again to stop the recording.

***Note** – The Record button turn greens when activated, and turns grey when deactivated.*

You have now successfully surveyed the line where the tile is to be installed or the ditch is to be cleaned.

Creating the design

1. From the Run screen, tap **Design** in the *FieldLevel II* tab:



2. From the *Section* drop-down list, select the section line that you want to design.

Note – *The section lines are labeled from S1 in the order that they surveyed in.*

3. The design screen works from the outlet at the left side of the screen, and runs the design uphill to the right. The direction of the profile is defined by the direction that it was surveyed. If your survey profile is displayed the wrong way around, change the setting in the *Direction* drop-down list from *Outlet at Survey Start* to *Outlet at Survey End*, or from *Outlet as Survey End* to *Outlet at Survey Start*.

4. Edit the constraint fields to your requirements.

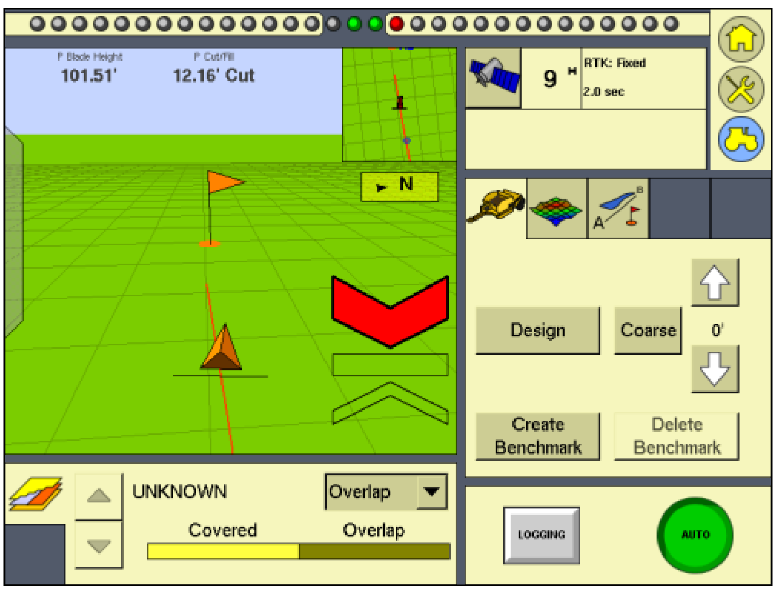
Constraint	Description
Min Depth	The minimum depth for the tile or ditch installation. The system will not allow the design profile to be any shallower than the minimum depth. The minimum depth is shown on the profile as a red line.
Optimal Depth	The depth to install the tile or ditch. The design will keep to this depth where it can. It will move off the optimal depth to be within the other constraints where it needs to.
Max Depth	The maximum depth for the tile or ditch installation. The system will not allow the design profile to be any deeper than the maximum depth. The maximum depth is shown on the profile as a blue line.

Constraint	Description
Min Slope	The minimum slope for the tile or ditch installation. The system will not allow the design slope to be any less than the minimum slope.
Outlet Depth	The depth at which the design profile will be at the outlet. The Outlet Depth can either be entered or measured. To measure the Outlet Depth, you can drop the tile plow into the ground so that the boot is at the same height as the main or outlet. Tap **Measure;** the outlet Depth is entered automatically. When you do this, another point is added onto the section line, providing that you are within 20m (65 ft) of the end of the surveyed section line. The height of the outlet is displayed on the profile in a yellow tag.

***Note** – For ditching applications, the Min Depth and Optimal Depth are set close to the surface.*

5. Tap **OK**.
6. In the Run screen, you can install the tile or clean the ditch from either the outlet or the top end of the profile. The section line that you install to appears as red on the screen, where other section lines are white.

   The virtual lightbar at the top of the FM-1000 integrated display's screen guides you onto the design profile:



***Note** – Specifically for the Autoslope leveling model, P Boot Depth shows the depth of the tile boot or the blade for ditching applications, and P Design Slope shows the current slope that the tile or ditch is being installed to. See* *FieldLevel status text items, page 223**).*

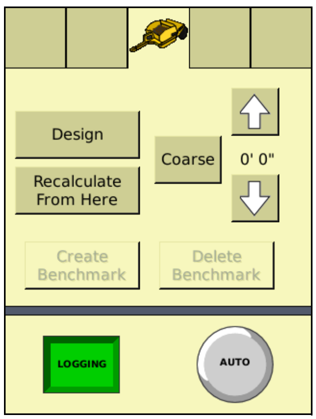
Driving in Flat Plane (Laser) and Flat Plane (GPS) modes

When driving in Flat Plane mode, the *Laser* and *GPS* options operate the same.

The FlatPlane (Laser) model results in a mathematically flat surface. This means that the plane does not follow the curvature of the Earth, but remains on a plane. Use this model when the land has previously been leveled with a laser system and you want to touch up the field.

The FlatPlane (GPS) model results in an equipotential surface meaning that the design surface is curved with surface of the Earth.

***Note** – Neither of these models can be used with a laser system; the entire FieldLevel II system only works with GPS.*

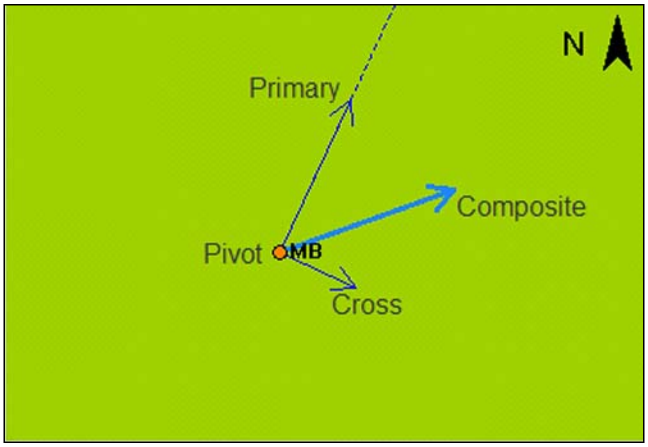


Tap…	To…
Design	enter the Plane Editor where you can edit the Design plane.
Bench or Rebench	create a benchmark, see Benchmarks, page 205. Set the Design Height equal to the Blade Height.
Down Arrow	raise the blade by the *Blade Step* amount.
Up Arrow	lower the blade by the *Blade Step* amount.
Auto	engage automatic blade height control: • starts the slope calculation • resets the height • resets the cut/fill
Coarse	move the blade by the *Coarse Blade Step* amount. To do this, press the + or - button.
Delete Benchmark	delete the benchmark at the current location. ***Note** – You do not have to drive over a benchmark to delete it.*
Logging	log the coverage, so that you can see on your map where you have been dependent on your implement width. A shape file is created with cut/fill and height information.

Defining a plane

You can define a plane in the *Plane Editor* on the FM-1000 integrated display. To do this, use at least one point as a pivot point and extra information based on direction and slope requirements.

The following figure show the required elements:



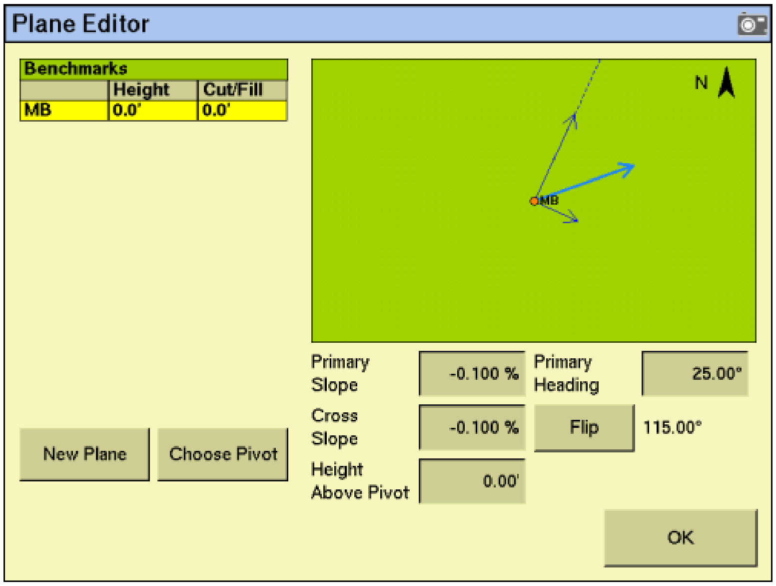
Element	Description
Pivot Benchmark	The single benchmark where the plane is defined. All slopes will pivot around this point.
Primary	The first axis upon which the slope is defined. It has a Primary Slope and Primary Heading component. The Primary Slope is defined as a negative number, where water will fall along the primary axis.
Cross	The second axis upon which the slope is defined. The Cross Heading will always be 90° or 270° from the Primary Heading. The Cross Slope is defined as a negative number, where water will fall along the cross axis. To define the plane by a single heading and slope, then you should set the Cross Slope value to 0.000%
Composite	When both Primary and Cross slopes are defined, the Composite Slope direction shows the actual heading where water will fall. If you have 0.000% slope on the Cross axis, the Composite Heading will be the same as the Primary Heading.

Defining a plane using a single point

1. From the Run screen, select the Survey/Design plugin and then create a benchmark that will be used to define the direction of the slope and its heading.

Note – *It can be useful to create the benchmark at the critical point; for example, where the water will enter or exit the field. This ensures that where the benchmark is, the plane is on grade.*

2. Select the FieldLevel II plugin and then tap **Design**:



3. If more than one benchmark is stored, tap **Choose Pivot** and then select the benchmark that you want to be on grade.
4. Tap **OK**. The *Plane Editor* screen appears.
5. If using a known offset, enter it into the *Height Above Pivot* field.
6. Enter the values for *Primary Slope*, *Primary Heading*, and *Cross Slope:*
   - For water to run along the Primary and Cross axis, the slope values must be keyed in as negative values.
   - If you want to define the primary heading by measuring a second point, see Defining a plane using multiple benchmarks, page 238.
7. To change the direction of the Cross Slope, tap **Flip**. This changes the *Cross Heading* between 90° and 270° from the *Primary Heading*.
8. The plane is now defined. Tap **OK**. The Run screen appears.

***Note** – The FieldLevel II plugin searches for a survey on the field. If there is a survey, a Cut/Fill map appears on the new design plane.*

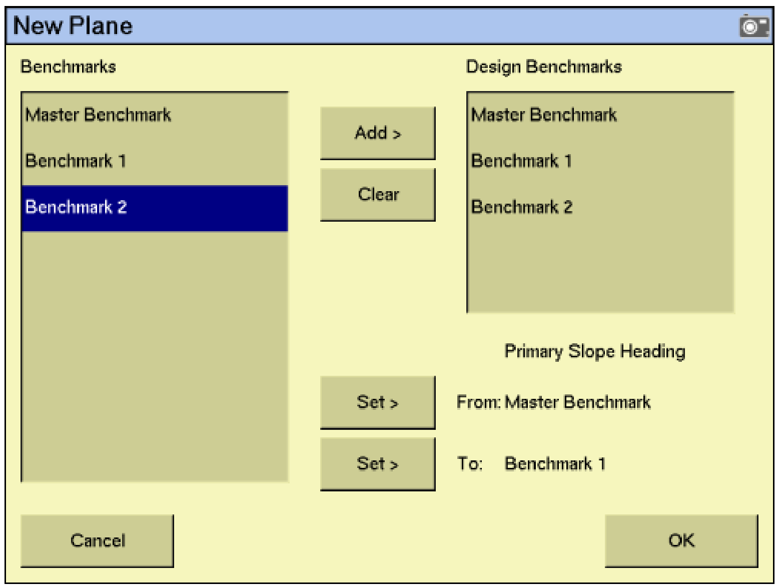
Defining a plane using multiple benchmarks

You can use multiple benchmarks to define a plane based on your specific requirements. If multiple benchmarks are created, you can design a plane of best-fit through those points.

If you use three benchmarks to design the plane, then the cut and fill values will be "0.0" through those points as the plugin can create a perfect plane. If you use more than three benchmarks to design the plane, the cut/fill values will be the residual difference between the plane of best-fit and the benchmark elevations.

To define a plane using multiple points, do the following:

1. From the Run screen, select the Survey/Design plugin and then create two or more benchmarks to help define the plane. If a primary heading definition is required you only need two benchmarks. If all the slopes of a field are to be defined, then you need at least three benchmarks.
2. Select the FieldLevel II plugin and tap the **Design** button. The *Plane Editor* screen appears.
3. Tap **New Plane**:

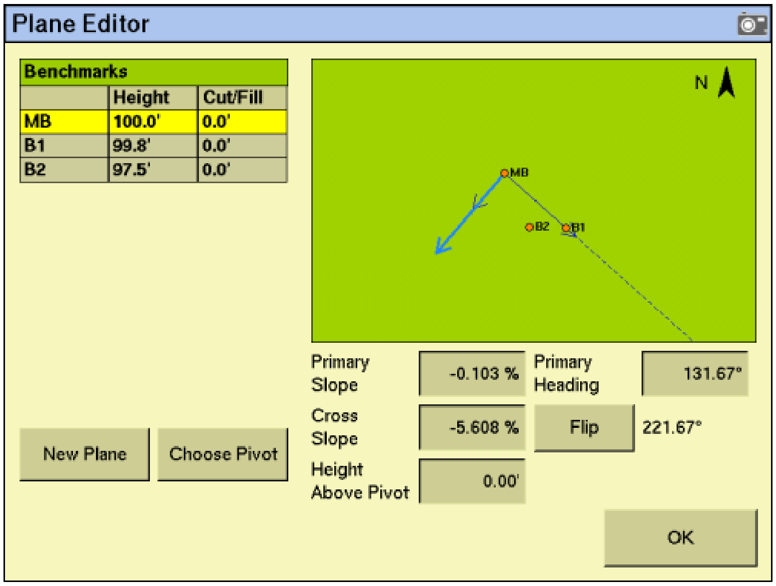


4. From the *Benchmarks* list, select the benchmark to be used as the primary pivot and then tap **Add**. The benchmark is be copied to the *Design Benchmarks* list.
5. Repeat Step 4 until all the required benchmarks are copied to the *Design Benchmarks* list. The *Design Benchmarks* list contains the benchmarks for the multi-point plane.
6. To set the *Primary Slope Heading*, choose the first benchmark to define the heading and then tap the *From:* **Set>** button.

***Note** – Trimble recommends that this point is the uphill point of the two points to be used to define the primary slope.*

7. Select the second point of the primary slope and then tap the *To:* **Set>** button.

8. Tap **OK**:



The selected benchmarks appear in the *Benchmarks* table along with their associated cut/fill values. The Primary Slope and Cross Slope values reflect the calculated slopes based on the benchmarks entered in the *New Plane* screen.

9. To update the slope values:

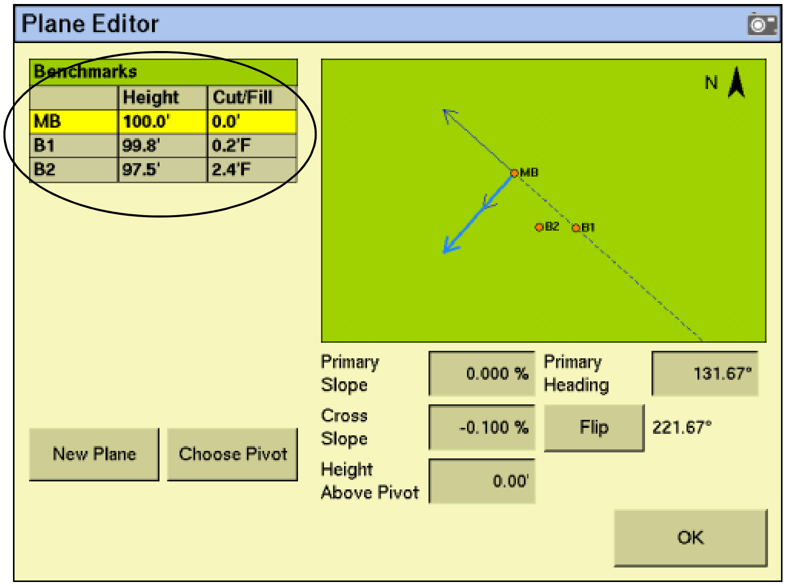
   a. Identify the benchmark to be used as the new pivot.

   b. Tap the **Choose Pivot** button. The *Choose Pivot* screen appears.

   c. From the *Choose Pivot* screen, select the benchmark to be used as a the pivot for the new slope from the screen.

   d. Tap **OK**. The *Plane Editor* screen appears.

10. Select the *Primary Slope*, *Cross Slope*, or *Height Above Pivot* areas to edit the slope values as required:



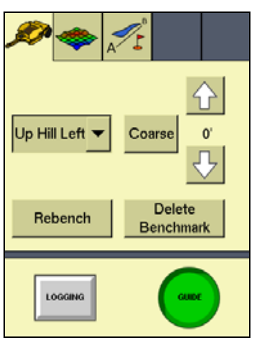
Note – *The cut/fill values in the Benchmarks table will update automatically.*

11. The plane is now defined. Tap **OK**. The Run screen appears.

Note – *The FieldLevel II system will search for a survey on the field. If there is a survey, a cut/fill map appears as the new design plane.*

Driving in Contour mode

When you drive in Contour mode, the *FieldLevel II* tab appears as follows:



Item	Description
Up Hill Left Up Hill Right	Select whichever of these buttons is appropriate: • If you are driving around the contour with the uphill slope on your left and the downhill slope on your right, select **Up Hill Left**. • If you are driving around the contour with the uphill slope on your right and the downhill slope on your left, select **Up Hill Right**.

Item	Description
Coarse	When selected, the Up and Down arrows change the blade height by the *Coarse Blade Step* amount. This enables you to move the blade by a large amount instead of small increments.
Up arrow	Increase the design height by the Blade Step amount.
Down arrow	Decrease the design height by the Blade Step amount.
Bench or Rebench	Create a benchmark, see Benchmarks, page 205. Set the Design Height equal to the Blade Height.
Guide	Select **Guide** to get lightbar guidance at the current level.
Logging	Logs the coverage, so that you can see on your map where you have been dependent on your Implement Width. A shape file is created with cut/fill and height information.

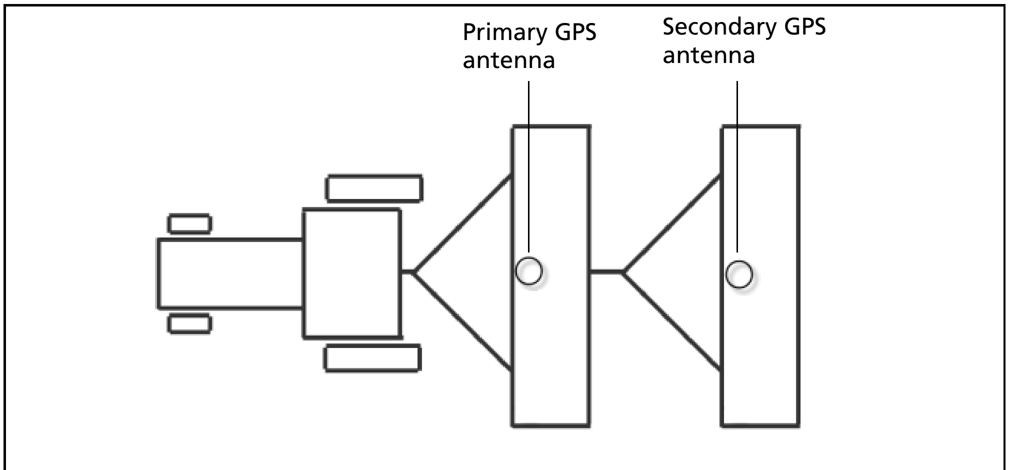
The FieldLevel II height indicators show you whether to raise or lower the blade so the contour remains at the same level.

1. In the Run screen, drive the vehicle to where you want to start the first levee and then set the master benchmark at this point.
2. Set which side of the vehicle is uphill. Tap **Guide**, drive the vehicle forward, following the lightbar to keep the vehicle on the same contour:
   – To move to the next levee, turn the vehicle around and change the *Up Hill* direction.
   – To step the blade up or down, use the and **^** and **v** buttons to achieve the required offset and then follow the lightbar to keep the correct grade.

Tandem or dual leveling plugin

Tandem scraper configuration

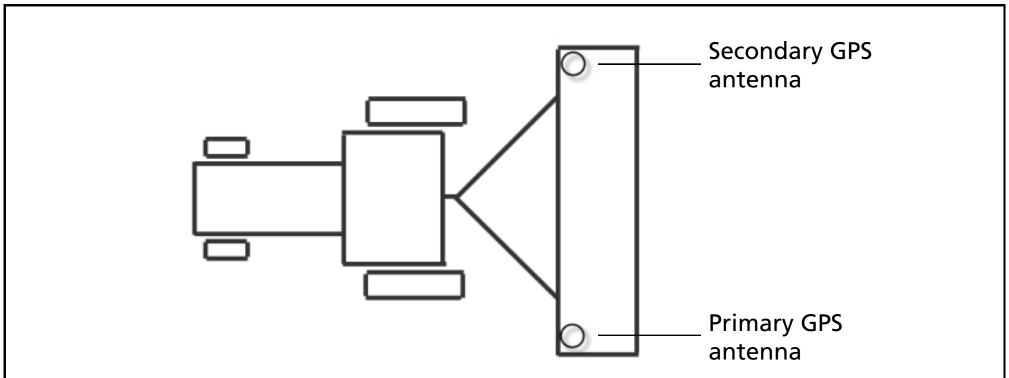
The tandem scraper configuration describes the practice of towing two scrapers, one behind the other. This type of leveling provides increased efficiency as it allows for the blade of each scraper to be controlled independently from the other. This means more dirt can be cut before you have to drive to a fill area and remove dirt from the scraper buckets.



Tandem Scraper system

Dual scraper configuration

The dual scraper configuration describes a single scraper with two GPS antennas, one at each end of the blade. This allows for control of the roll of the blade, giving a more accurate surface. This configuration is ideal for complex surfaces with high variability slopes.



Dual Scraper system

***Note** – For the FieldLevel II dual system you must use a scraper with dual hydraulic controls.*

Configuring the Tandem/Dual plugin

***Note** – Before you can configure the system, it must be professionally installed. For more information, contact your local reseller.*

There are six steps to complete:

- Step 1. Configuring the implement
- Step 2. Preparing the FM-1000 integrated display and antenna connections
- Step 3. Configuring the primary receiver
- Step 4. Configuring the secondary receiver
- Step 5. Configuring the Tandem/Dual plugin
- Step 6. Calibrating the Tandem/Dual valve module

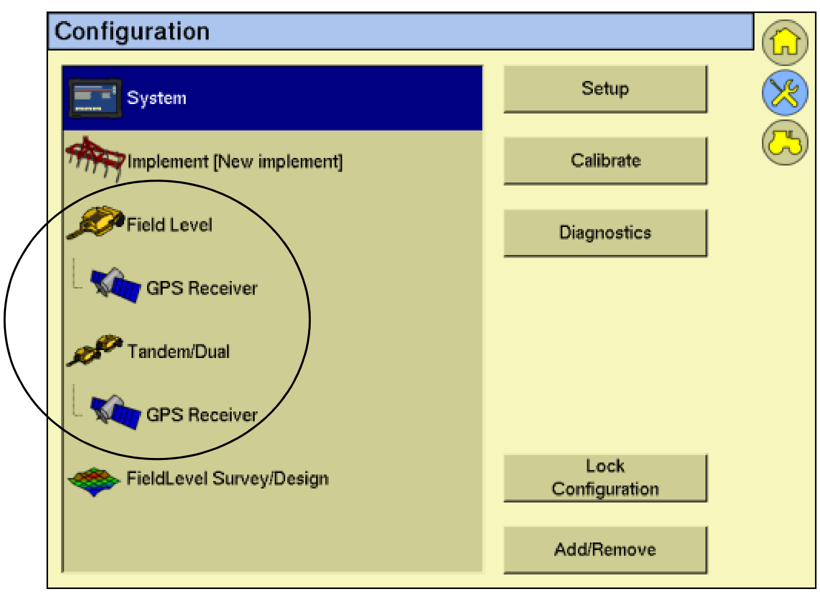
Step 1. Configuring the implement

If you have not already configured the implement, see Configuring the implement for leveling, page 204.

Step 2. Preparing the FM-1000 integrated display and antenna connections

If not already installed on the FM-1000 integrated display, install the FieldLevel II plugin, followed by the Tandem/Dual plugin (for more information, see Adding or removing a plugin, page 194)

When both plugins are installed, the *Configuration* screen will show both the FieldLevel II plugin with its associated GPS receiver, and the Tandem/Dual plugin with its associated GPS receiver:



Connect the FieldLevel II plugin (primary) antenna to the GPS1 connector (❶) on the rear of the display, and connect the Tandem/Dual plugin (secondary) antenna to the GPS2 connector (❷) on the rear of the display:

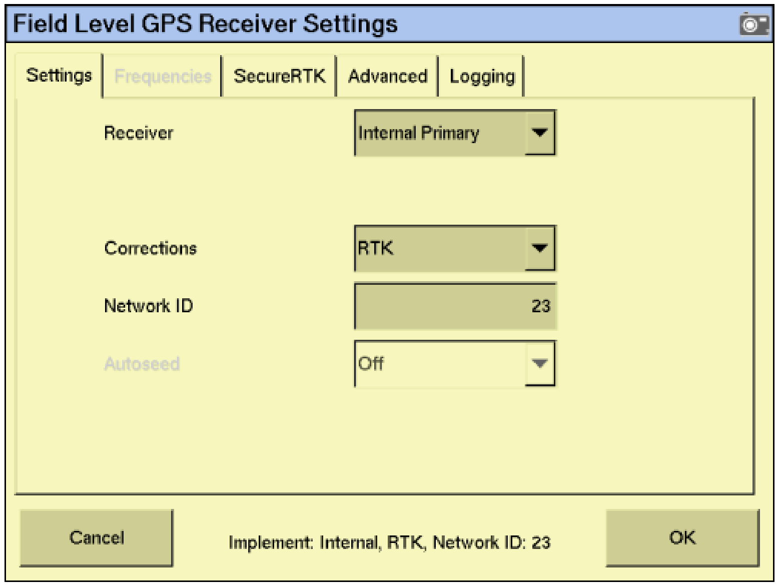
The correct configuration for the antennas on the implement/s is as follows:

FM-1000 integrated display port	Plugin	Receiver position (Tandem set-up)	Receiver position (Dual set-up)
GPS1 (❶)	FieldLevel II	Front	Left
GPS2 (❷)	Tandem Dual	Rear	Right

Step 3. Configuring the primary receiver

The FieldLevel II plugin controls the primary receiver.

1. From the *Configuration* screen, select the GPS receiver listed below the Field Level plugin and then tap **Setup**:

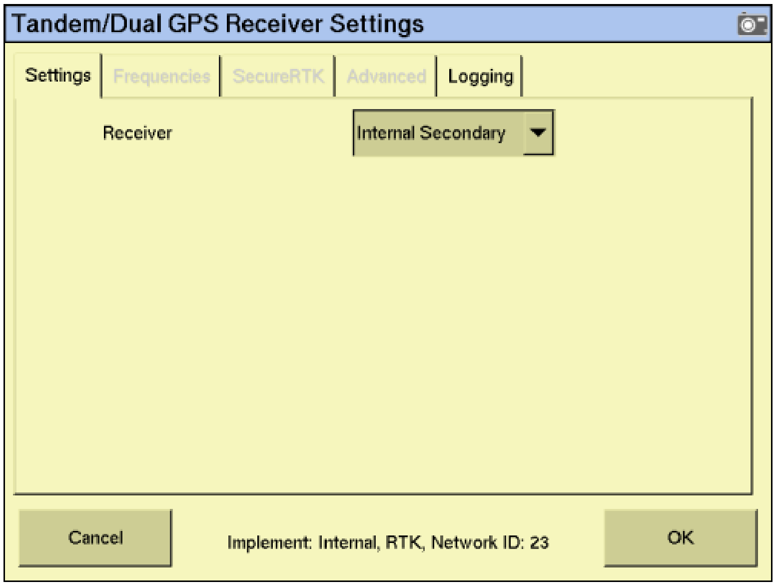


2. From the *Receiver* drop-down list, select *Internal Primary*.
3. From the *Corrections* drop-down list, select *RTK*.
4. Set the *Network ID* field to the same network ID that is set in the base receiver.

Step 4. Configuring the secondary receiver

The Tandem/Dual plugin controls the secondary receiver.

1. From the *Configuration* screen, select the GPS receiver listed below the Tandem/Dual plugin and then tap **Setup**:

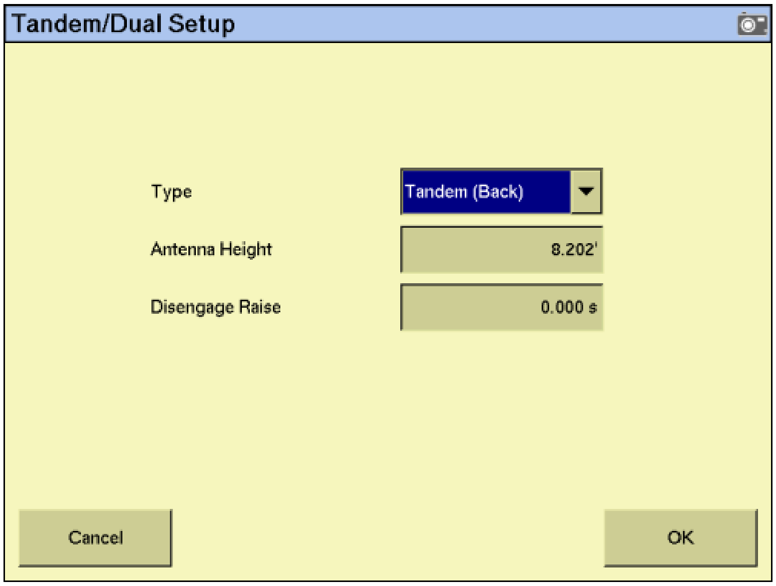


2. From the *Receiver* drop-down list, select *Internal Secondary*.

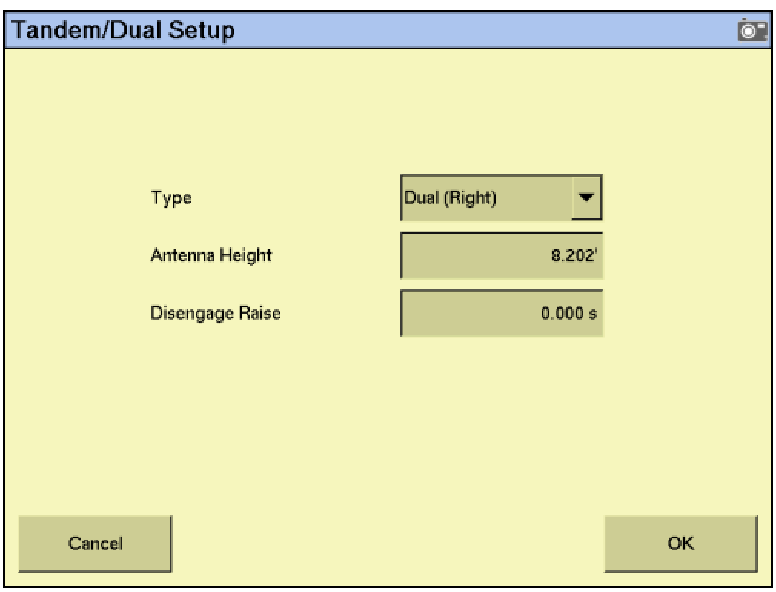
Step 5. Configuring the Tandem/Dual plugin

The FM-1000 integrated display must be configured to control the Tandem/Dual plugin in either a tandem configuration or a dual configuration, depending upon the implement/s being used.

1. From the *Configuration* screen, select the Tandem/Dual plugin and then tap **Setup**:



2. By default, the *Type* field is set to *Tandem (Back)* and can control two implements, one towed behind the other. If a single implement is to be used in a dual configuration, select *Dual (Right)* from the *Type* drop-down list:



3. Enter the appropriate value in the *Antenna Height* field.

This value relates to the antenna installed on either the rear implement, or the antenna installed on the right side of a single implement.

***Note** – In the FieldLevel II plugin, the Antenna Height value can be altered from the Blade Settings tab and relates to the antenna installed on either the front implement, or the antenna installed on the left side of a single implement.*

***Note** – Measure the antenna height vertically, from the ground to the base of the antenna*

4. Enter the appropriate value in the *Disengage Raise* field.

   This value is used to control the rear implement or the right side of a single implement when Auto is disengaged. If you set it to 0.000s then the blade will not move up when you disengage.

***Note** – In the FieldLevel II plugin, the Disengage Raise value can be altered from the Blade Settings tab and relates to the front implement's blade, or the left side of the blade on a single implement.*

***Note** – For a tandem system, you will want to move the blade up when Auto is disengaged on both the front and back implements as you will be swapping between the two. For a dual setup with a single implement, Trimble recommends that you have the left and right Disengage Raise values set to the same value.*

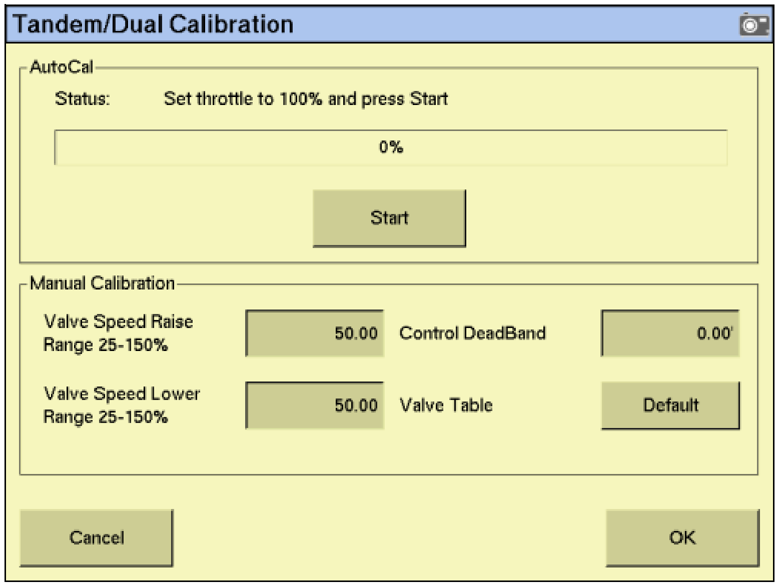
Step 6. Calibrating the Tandem/Dual valve module

When working with a tandem/dual configuration, the valve module must be calibrated for both the FieldLevel II plugin and the Tandem/Dual plugin.

- The Fieldlevel II plugin valve calibration relates to the front implement cylinder in a tandem configuration, or the left side cylinder of a single implement.
- The Tandem/Dual plugin valve calibration relates to the rear implement cylinder in a tandem configuration, or the right side cylinder of a single implement.
- Depending on the make and manufacturer of your vehicle, the tractor computer may need to be put into a special mode. Please refer to the FieldLevel II Installation Guide for your vehicle type.

To calibrate the valve module:

1. From the *Configuration* screen, select the Tandem/Dual plugin and then tap **Calibrate**:



2. Set the vehicle throttle to 100%.
3. Tap **Start**.

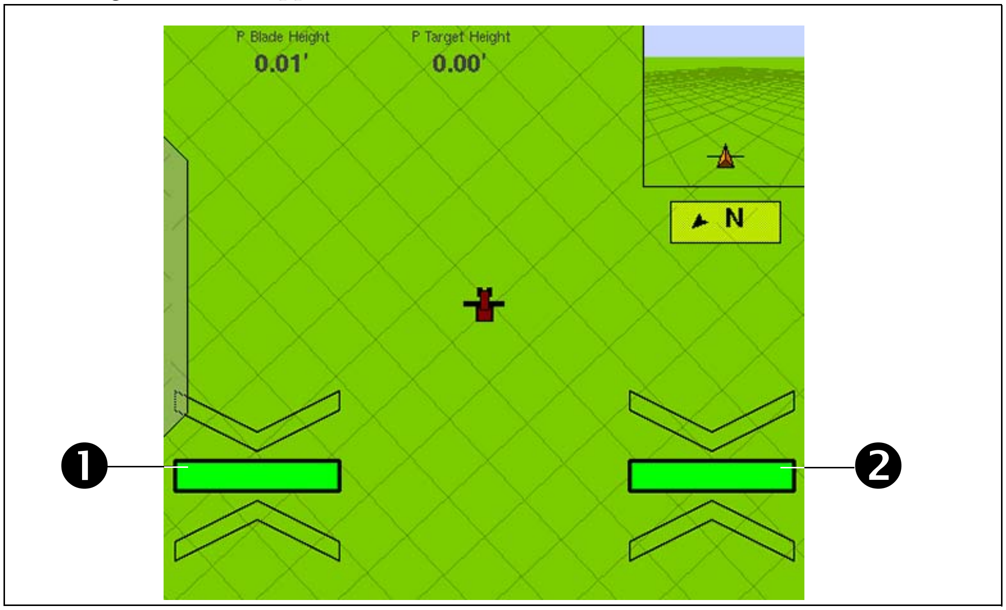
   The system performs its calibration sequence to test the speed at which the blade raises and lowers. This process takes approximately 8 – 10 minutes.

To manually calibrate the valve, enter values in the three *Manual Calibration* fields and then tap **OK**.

Operating the Tandem/Dual plugin

Blade height indicators

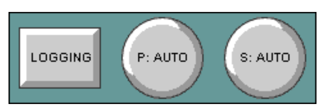
Once you install and configure tandem mode (two implements each with a GPS receiver), or dual mode (a single implement with a GPS receiver at each end), a second blade height indicator appears on the Run screen:



Item	Description
❶	Primary (left side) implement height indicator
❷	Secondary (right side) implement height indicator

These operate in the same way as the single receiver FieldLevel height indicators. See Blade position indicators, page 223.

Auto buttons



With a tandem/dual configuration, the Autopilot **Engage** button is replaced with two FieldLevel **Auto** buttons:

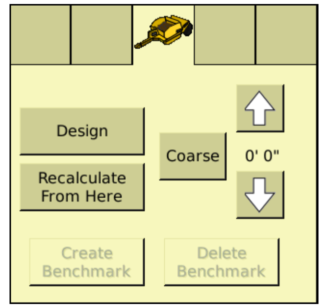
- With a tandem configuration, the **P:Auto** button controls the automatics of the primary (front) implement and the **S:Auto** button controls the automatics of the secondary (rear) implement.
- With a dual configuration, the **P:Auto** button controls the automatics on the primary (left) side of the implement and the **S:Auto** button controls the automatics on the secondary (right) side of the implement.

***Note** – To control both sides of the implement simultaneously when using a dual configuration, you must tap both buttons.*

Note – *With the addition of an external GPS receiver, you can use the Autopilot system with tandem and dual systems. An* **Engage** *button appears next to the* **P:Auto** *and* **S:Auto** *buttons.*

The FieldLevel II tab (dual mode)

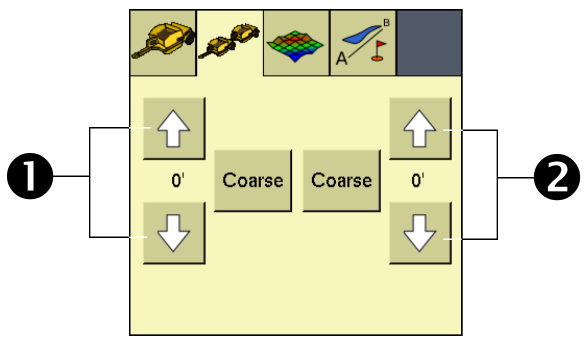
The ***standard*** *FieldLevel II* tab in dual mode has a single set of up and down buttons.



These buttons control the height of the whole implement. Use them to raise or lower both sides of the implement simultaneously. For example, if the blade is on an angle and you raise it with the up arrow on the standard FieldLevel II plugin, the blade remains at the original angle.

The Tandem/Dual tab

For both tandem and dual mode, the *Tandem/Dual* tab includes a double set of up and down buttons. These buttons provide independent control of the implement offset:



Item	Description
❶	Primary (front or left side) implement height control
❷	Secondary (rear or right side) implement height control

- For a tandem configuration:
  - the ***left*** up and down buttons offset the height of the ***primary*** (front) implement
  - the ***right*** buttons offset the height of the ***secondary*** (rear) implement.
- For a dual configuration:
  - the ***left*** buttons offset the height of the ***primary*** (left) side of the implement
  - the ***right*** buttons offset the height of the ***secondary*** (right) side of the implement.

CHAPTER

10

The Field-IQ Plugin

In this chapter:

This chapter describes how to calibrate, configure, and operate the Field-IQ™ crop input control system with the FM-1000 integrated display.

Introduction

When the Field-IQ plugin is installed, the FM-1000 integrated display can control planters, sprayers, liquid strip-till tool-bars, and spinner spreaders. It can perform automatic section control using Tru Count air clutches, boom valves, LiquiBlock, and various section control devices while also controlling rates using a prescription with Rawson drives, servo valves, PWM valves, and various flow control devices. This chapter explains how to configure and use the Field-IQ plugin.

Different functions of the plugin can be configured and controlled by Field-IQ as follows:

Application	Main functions
Planter	• Seed Section Control of up to 48 individual rows (Field-IQ section control module(s) needed) using Tru Count air clutches. • Seed Rate Control using up to 4 Rawson drives to change seed population (Field-IQ Rawson Control Module(s) needed). • Liquid Fertilizer Control of up to 48 individual liquid nozzles (Field-IQ section control module(s) needed) using Tru Count LiquiBlock valves. • Variety tracking.
Sprayer	• Liquid Rate Control, using either a PWM or Servo control valve. • Liquid Section Control of up to 48 individual spray nozzles (Field-IQ Section Control Module(s) needed) using Tru Count LiquiBlock valves.
Strip-till (liquid)	• Liquid Section Control of up to 48 individual spray nozzles (Field-IQ Section Control Module(s) needed) using Tru Count LiquiBlock valves. • Liquid Rate Control using up to 2 Rawson drives connected to ***fixed displacement pumps,*** such as CDS-John Blue piston pumps, to change liquid rate (Field-IQ Rawson Control Module(s) needed). • Liquid Rate Control using either a PWM or Servo control valve and flow meter.
Spreading	• Spreading Rate Control using a Rawson Drive (Field-IQ Rawson Control Module(s) needed). • Spreading Rate Control using either a PWM or Servo control valve and application rate sensor.

Definitions

Term	Definition
Material	A product that is controlled by a PWM valve, Servo valve, or Rawson drive. You can use a planter (seed), liquid, granular seed and granular fertilizer, all of which have different set-up parameters.
Section	A number of rows or spray nozzles that are controlled by Tru Count air clutches or Tru Count LiquiBlock valves. A section can have either a single row/nozzle or multiple rows/nozzles depending on how the system is set up.
Row	The individual row unit which seed comes from on the planter. This can be controlled individually as a single row section, or as a group with other rows in a multiple row section.

Units of measure

Type	Unit	Symbol	Description
Seed	Metric US/Imperial	kS/ha kS/a	Thousands of seeds per hectare Thousands of seeds per acre
Granular seed	Metric US/Imperial	kg/ha lbs/a	Kilograms of seed per hectare Pounds of seed per acre
Liquid application	Metric US/Imperial	L/ha Gal/a	Liters per hectare Gallons per acre
Granular fertilizer	Metric US/Imperial	kg/ha lbs/a	Kilograms of fertilizer per hectare Pounds of fertilizer per acre

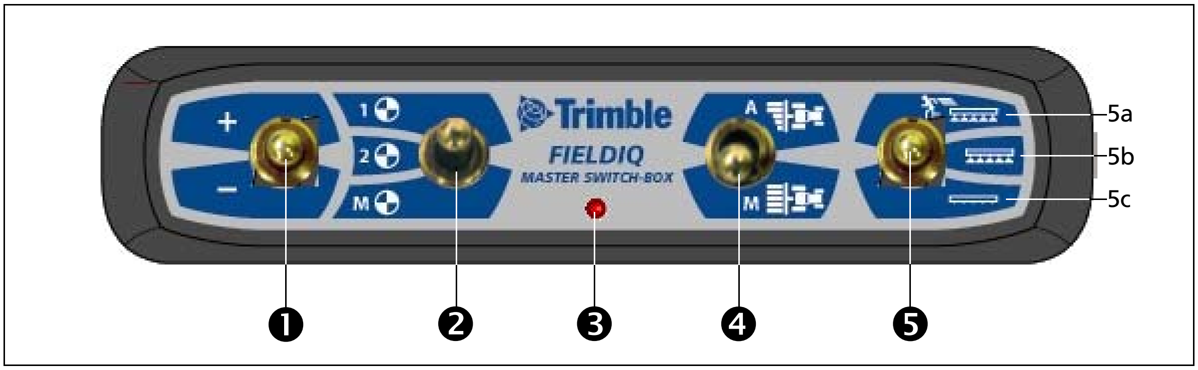
Installing the Field-IQ hardware

For information on installing the Field-IQ crop input control system on your implement, refer to:

- *Field-IQ Platform Installation Instructions*
- *Tru Count Air Clutch Installation Instructions*
- *Rawson Installation Instructions*

For the latest versions of these documents, go to www.trimble.com/agriculture.

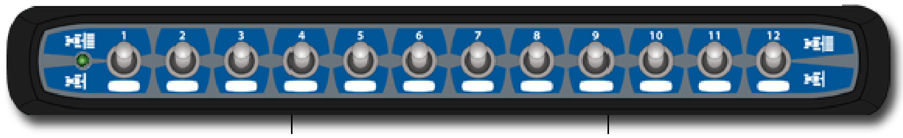
Field-IQ master switch box functions



	Feature	Function
❶	Increment/decrement switch	Increases the applied amount by a set amount (the amount set in the Setup screen, Rate tab).
❷	Rate switch	Choose to use preset Rate 1, preset Rate 2, or Manual rate.
❸	LED indicator	Red – Unit is powered but not communicating with the FM-1000. Green – Unit is powered and communicating with the FM-1000. Yellow – Unit is initializing communications with the FM-1000.
❹	Automatic/Manual section switch	Automatic mode – The FM-1000 integrated display automatically opens and closes sections when entering areas of overlap, non-apply zones, or crossing boundaries. Manual mode – The sections are controlled by the user using the Field-IQ system. **Tip –** You can switch from Automatic to Manual mode while traveling.
❺	Master switch	• 5a: Jump start position. The same functions as in Master On are active, plus the system is overridden to use a preset control speed (the speed is set in the *Setup* screen, *Override* tab). • 5b: On position. The sections and rate are ready to be commanded by the FM-1000 integrated display. • 5c: Off position. Sections are closed and rate is set to zero. **Tip –** Use the jump start function if you lose a GPS signal or you want to start applying before your implement is up to speed.

***Note** – All systems are required to have a Field-IQ master switch box.*

Field-IQ 12-section switch box (optional)



Only one section switch box can be used on each system. Each section switch is automatically assigned to the corresponding section. The sections are read from left to right. For example, switch 1 assigns to the section furthest on the left when standing behind the implement. For more information, see the Hardware tab in *Setup* screen of the Field-IQ plugin.

The section switches have different functions, depending upon the status of the master Automatic/Manual section control switch on the master switch box.

When the Automatic/Manual section control switch is in the ***Automatic*** position:

- If the section switch is in the on/up position the section(s) assigned to it are commanded automatically by the FM-1000 integrated display.
- If the section switch is in the off/down position the section(s) assigned to it are commanded to be off.

When the Automatic/Manual section control switch is in the ***Manual*** position:

- If the section switch is in the on/up position, the section(s) assigned to it are commanded to be on. This overrides the FM-1000 integrated display and coverage logging is ignored.
- If the section switch is in the off/down position, the section(s) assigned to it are commanded to be off. This overrides the FM-1000 integrated display and coverage logging is ignored.

The LED has the following status indicators:

- Green – The unit is powered and is communicating with the FM-1000 integrated display.
- Yellow – The unit is initializing communications with the FM-1000 integrated display.
- Red – The unit is powered but not communicating with the FM-1000 integrated display.

Field-IQ Planting

Before starting the Field-IQ plugin setup on the FM-1000 integrated display, ensure that:

- all components of the system are installed on the vehicle and implement.
- the Field-IQ plugin has been added to the FM-1000 integrated display configuration.

  On the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Ensure that the Field-IQ icon appears in the list. If the icon does not appear tap **Add/Remove** to add the plugin to the configuration.
- the Implement Setup has Planting as the selected operation.

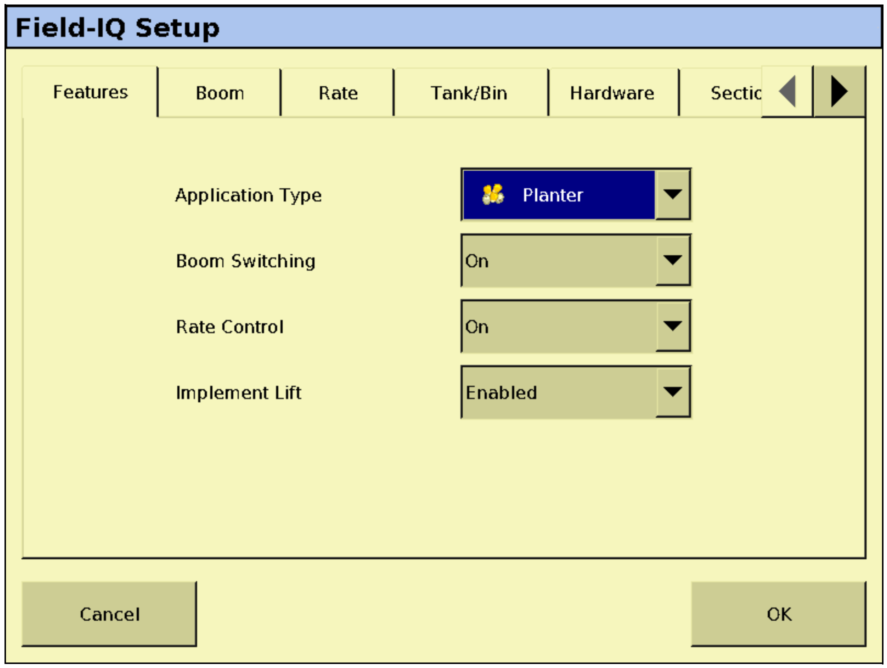
  On the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Select the implement from the list on the left and then tap **Setup**. The *Implement Setup* screen appears. In the *Operations* tab, select Planting and then tap **OK**.

For more information about setting up the implement, see Chapter 7, Implement Configuration.

Field-IQ setup for planting with Rawson drives and / or Tru Count air clutches

1. On the Home screen, tap the  icon. The *Configuration Selection* screen appears.
2. Next to Implement, tap **Edit**. The *Configuration* screen appears.
3. Select the Field-IQ plugin and then tap **Setup**.

Features tab



1. In the *Application Type* drop-down list, ensure that Planter is selected.
2. In the *Boom Switching* drop-down list, select either On or Off.

   When On is selected, Automatic Section Control is active and at least one Field-IQ section control module must be installed.
3. In the *Rate Control* drop-down list, select either On or Off.

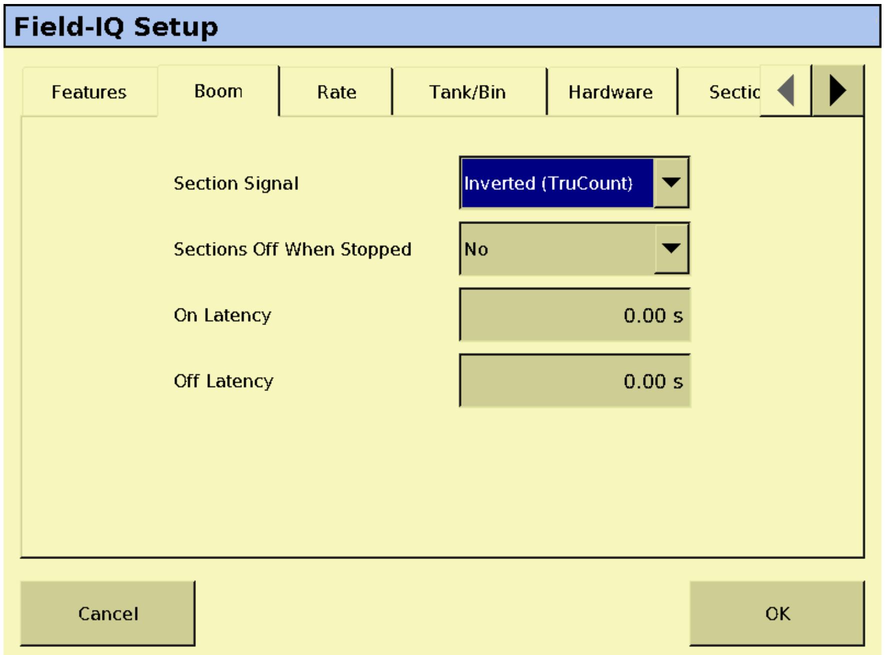
   When On is selected, Rate Control is active and at least one Field-IQ Rawson control module must be installed.
4. In the *Implement Lift* field, select either Enabled or Disabled.

   Select Enabled for the system to use the implement lift to start and stop coverage logging.

   Select Disabled for the system to ignore the implement lift switch (if installed). You can manually control coverage logging from the Run screen.

Boom tab

1. Select the *Boom* tab:



2. In the *Section Signal* drop-down list, select an option to control whether the system sends a high or a low signal to close a section valve.

   Select Air Clutch when using a Tru Count inverter box.

   Select Tru Count when using Tru Count Clutches, Tru Count Liqui-Block valves, or John Deere row clutches.

CAUTION – Selecting the incorrect value causes the system to operate opposite of the required result.

3. In the *Turn Off When Stopped* drop-down list, select an option.

   Selecting Yes turns off sections when the GPS speed is zero.

4. In the *On Latency* field, enter a value.

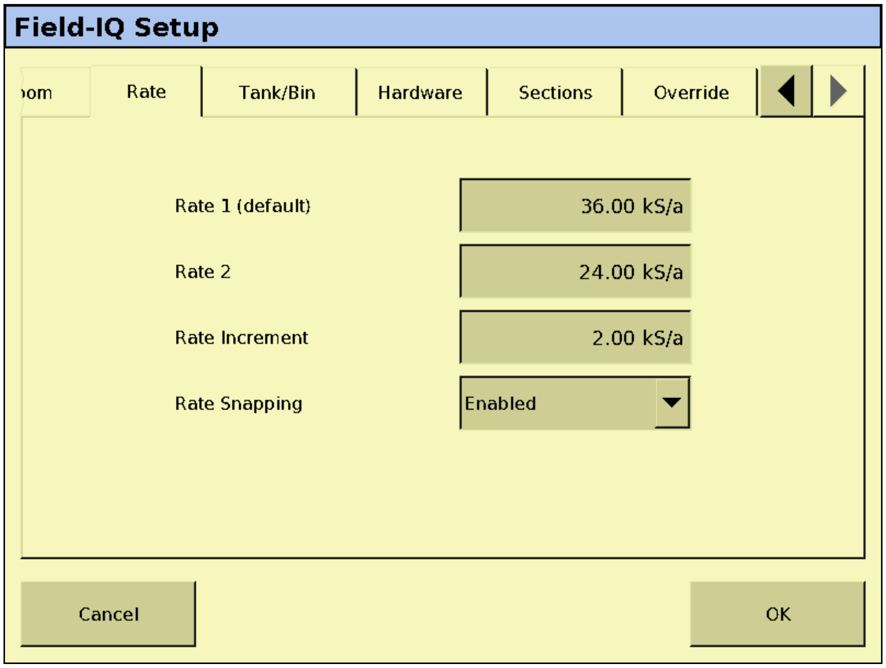
   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch (this can happen on larger systems). In this case, increase the On Latency value to compensate the clutch delay, and Field-IQ will turn the clutches on before they need to be turned on.

5. Enter a value in the *Off Latency* field.

   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch (this can happen on larger systems). In this case, increase to compensate the clutch delay, and Field-IQ will turn the clutches off before they need to be turned off.

Rate tab

1. Select the *Rate* tab:

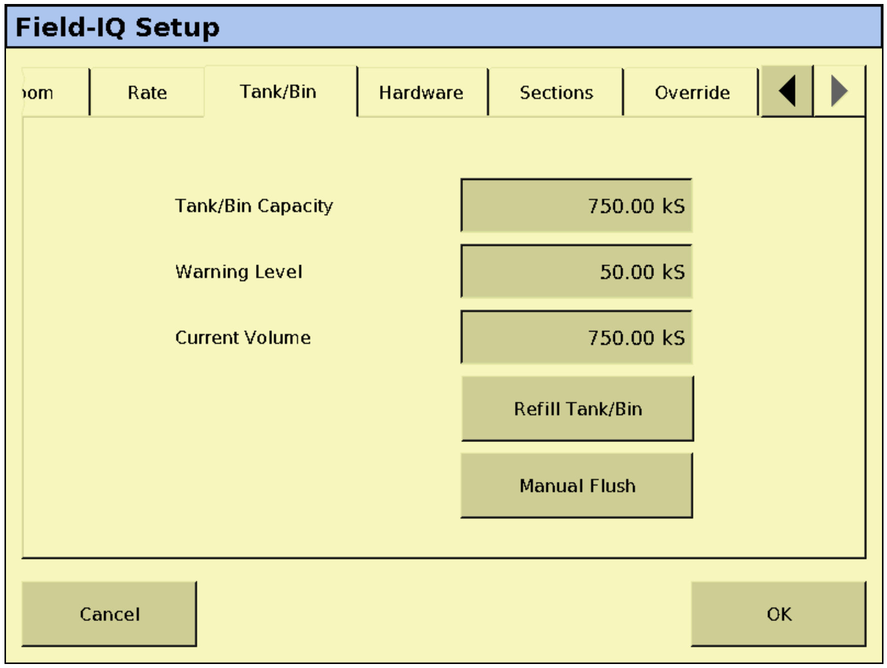


Note *– The Rate tab is only visible if you have at least one Field-IQ Rawson control module installed.*

2. In the *Rate 1* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 1.
3. In the *Rate 2* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 2.
4. In the *Rate Increment* field, enter a value. This is the increment to be used each time the Increment/Decrement switch is pressed.
5. In the *Rate Snapping* drop-down list, select an option:
   - Select Enabled to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate.
   - Select Disabled to show the actual applied value.

Tank/Bin tab

1. Select the *Tank/Bin* tab:



***Note** – The Tank/Bin tab is only visible if at least one Field-IQ Rawson control module is installed.*

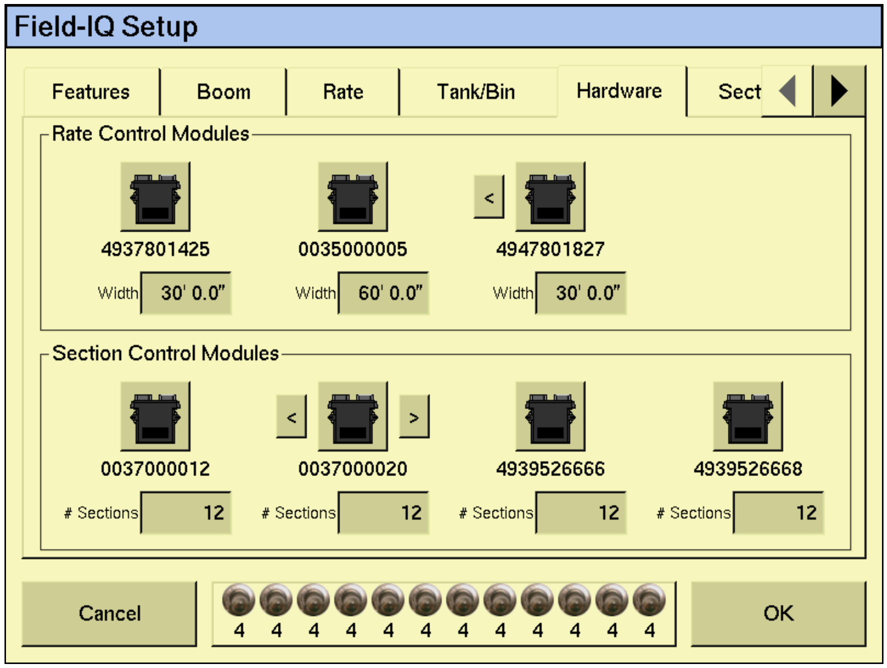
2. In the *Tank/Bin Capacity* field, enter the total capacity of the planter.
3. In the *Warning Level* field, enter the level at which you will receive notification when the capacity level drops below the assigned value.
4. In the *Current Volume* field, enter the current volume of the tank.

Tip – Tap **Refill Tank/Bin** to set the current volume to the tank/bin capacity.

Tip – To empty the tank/bin contents, tap **Manual Flush**. This engages the Variable Rate Drive continuously, without moving the implement.

Hardware tab

1. Select the *Hardware* tab:



***Note** – The numbers beneath each switch are the number of sections assigned to the switch. That is, switch 1 controls rows 1 through 4, switch 2 controls rows 5 through 8, and so forth. You cannot change the numbers as they are automatically assigned. If you are not using the 12-section switch box, a "virtual" switch box with six sections is shown.*

***Note** – Modules appear in the order they are installed on the implement, viewed by standing behind the implement and looking in the general direction of travel.*

Tip – To change the order of the modules on the *Hardware* tab, tap the icon of the module you want to move and then tap the directional arrows to move the icon.

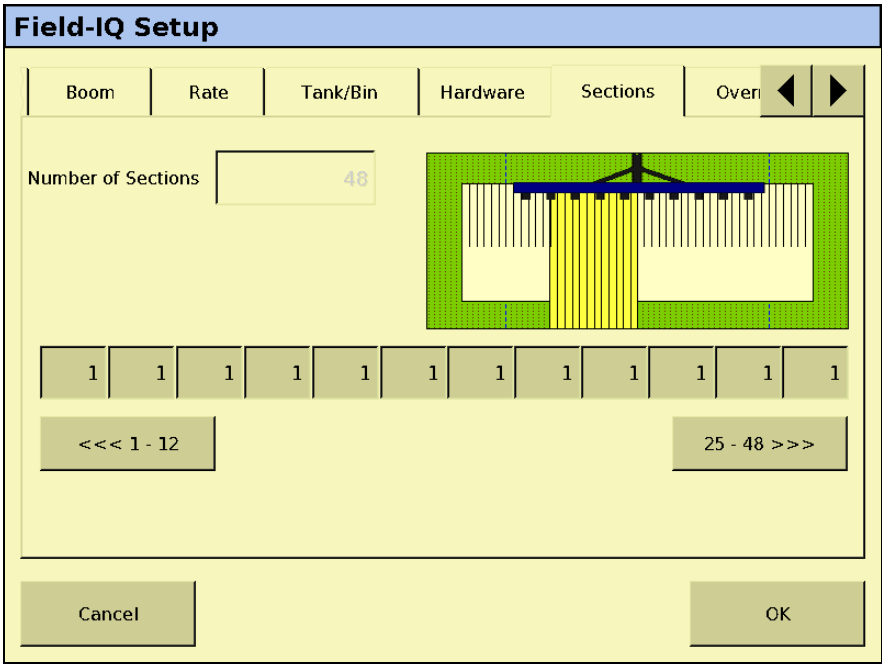
2. Adjust the width value for each rate control module by tapping the *Width* box. Enter the appropriate value and then tap **OK**.

3. If the total width of the modules does not equal the application width of the implement, an error message appears. To automatically change the control width of the Rate Control Modules to correct the error, tap **Adjust**. To return to the module edit page to manually correct the error, tap **Edit**. If the implement application width is incorrect, use the *Implement Setup* screen – *Guidance* tab to adjust it.

4. Adjust the sections value for each section control module by tapping the *Sections* box. Enter the appropriate value and then tap **OK**.

Sections tab

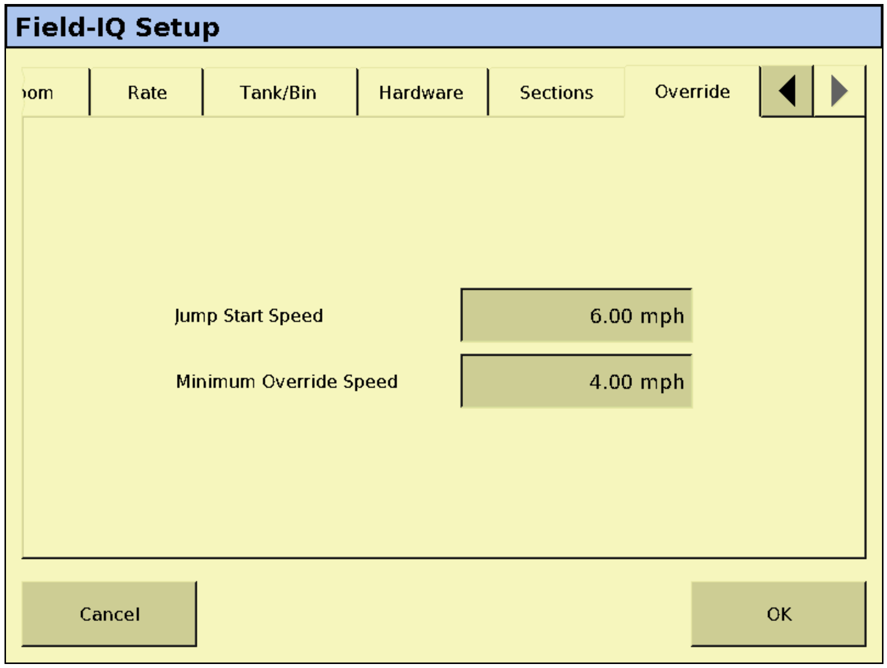
1. Select the *Sections* tab:



2. Enter the number of rows controlled for each section.
3. If the implement has more than 12 sections, use the buttons below the 12 section fields to scroll to the other sections.

Override tab

1. Select the *Override* tab:



2. In the *Jump Start Speed* field, enter a value.

   This setting controls the control speed to be used when the Field-IQ master switch box Master switch is put in the jump start position.

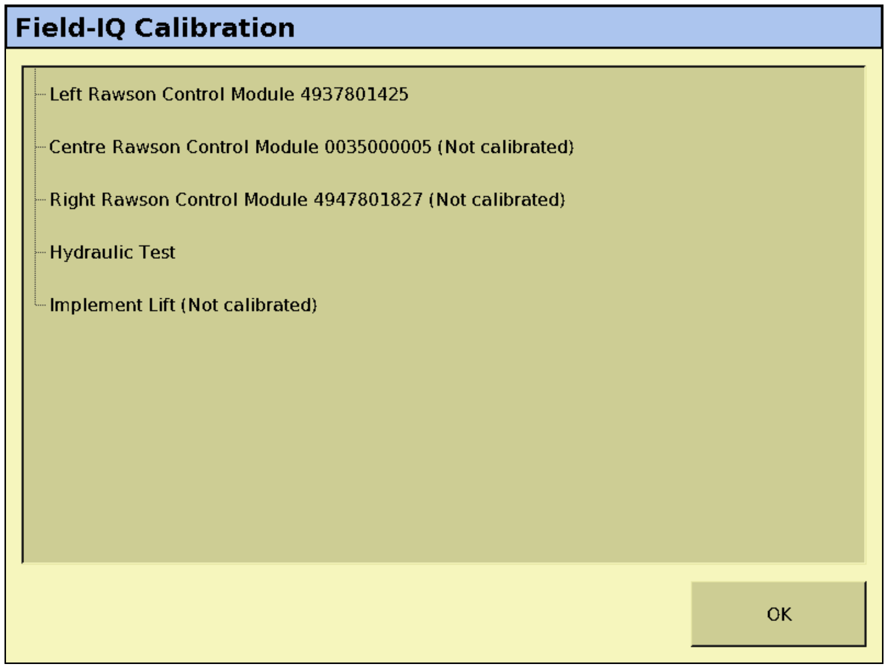
3. In the *Minimum Override Speed* field, enter a value.

   This setting maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds that may reach the physical limitations of the system.

Calibrating the modules

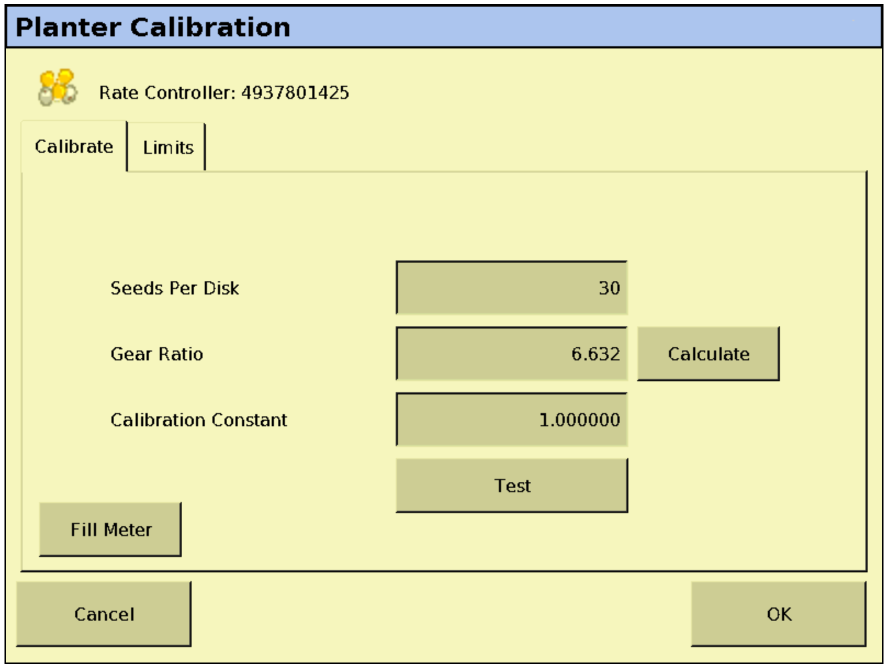
The Field-IQ *Calibrate* option only appears on the *Configuration* screen if you have at least one Field-IQ Rawson control module installed.

1. From the *Configuration* screen, select the Field-IQ plugin and then tap **Calibrate**.
2. From the *Field-IQ Calibration* screen, select the Rawson Control Module to be calibrated. The message Not calibrated appears at the end of the modules that need calibration:

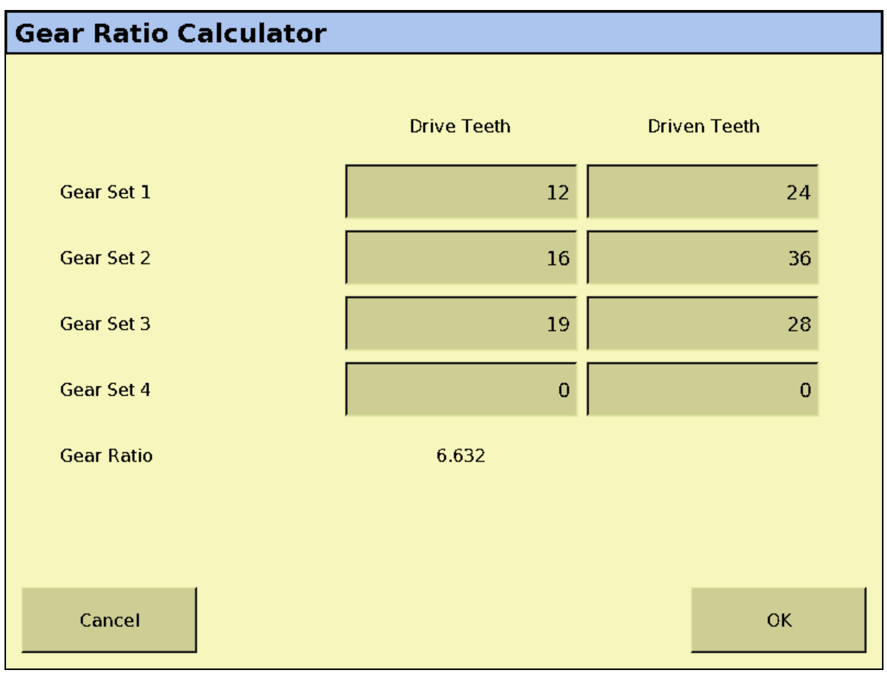


The *Planter Calibration* screen appears.

3. In the *Seeds Per Disk field*, enter a value. This is the number of seeds each seed disk holds:



4. Enter a value in the *Gear Ratio* field or tap **Calculate**. If you tap **Calculate**, the following screen appears:



5. Use the Gear Ratio Calculator to determine the planter drive gear ratio and then tap **OK**.

The *Calibration Constant* field contains a calculated value that the system determines during calibration.

This field allows adjustment for inconsistencies in the seed meters. To start out, Trimble recommends that you leave the value at 1.000. After the calibration test, the system may adjust this number.

6. Place a clean empty container under the rows that contain seeds to capture the seeds dispensed during the calibration.

CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

7. Tap **Test**:

   a. The system asks if you would like to prime the system. Tap **Yes**. To to ensure that the seed disk is full, the system turns the seed disks one revolution.

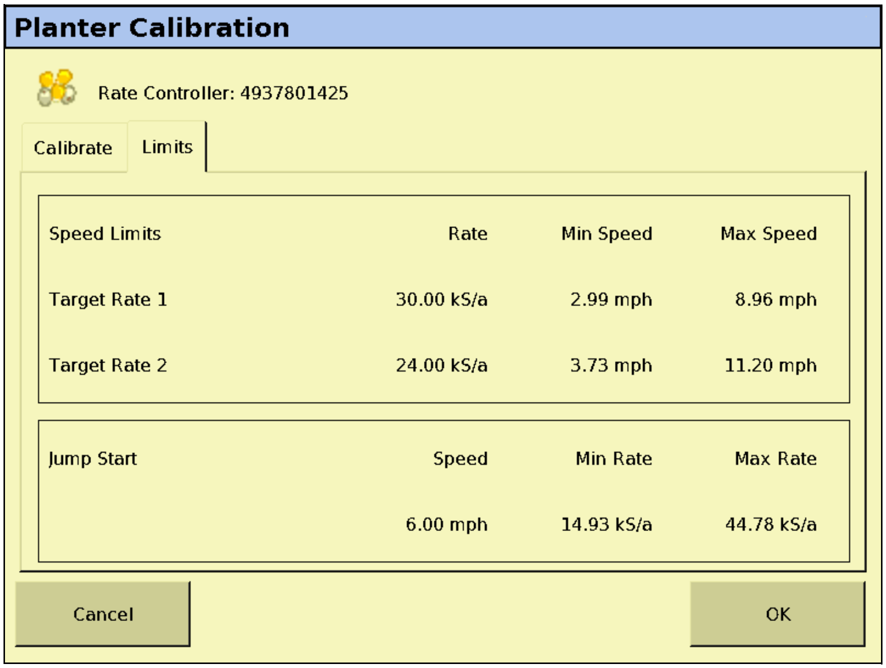
   b. Turn on the master switch to prime the system and then when prompted on-screen, turn off the master switch.

   c. In the *Number of Seed Meter Revolutions*, enter a value and then tap **Start**. The higher the number of revolutions the more accurate the calibration. Trimble recommends 5 to 10 revolutions.

   d. Follow the on-screen prompts of operating the master switch. After the system turns the specified number of revolutions, enter the number of seeds dispensed per row and then tap **Continue**.

   e. The next screen shows the minimum and maximum speeds for the target rate specified. Tap **OK** and then either press **Test** to repeat the calibration or tap **OK** to continue.

8. Select the *Limits* tab to show an overview of the limits that are set:



9. Tap **OK**.
10. Repeat Step 1 through Step 9 for other Rawson Control Modules that need calibration.

Hydraulic test

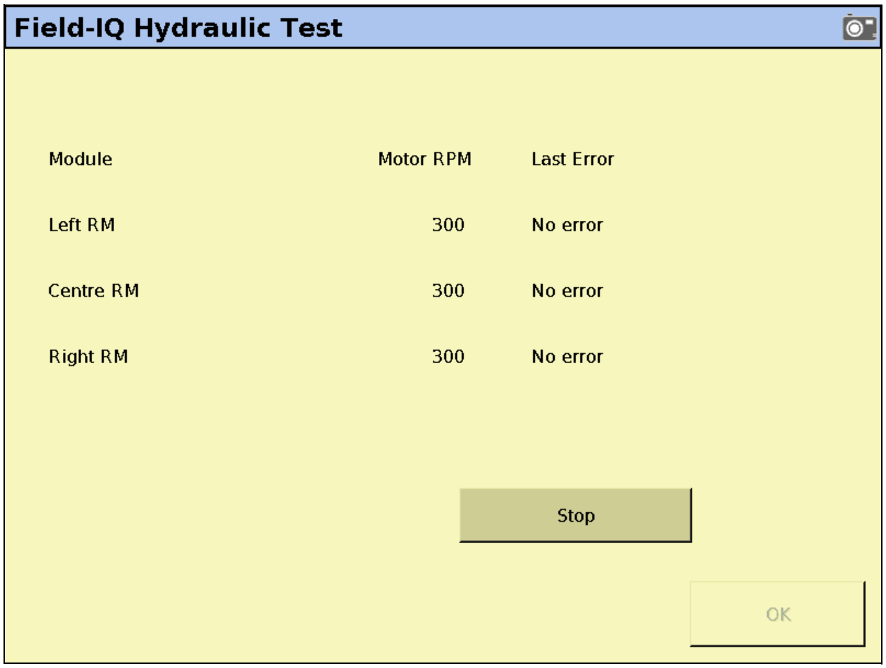
The purpose of this test is to exercise the hydraulics to establish whether there is sufficient oil flow to run the system.

1. From the Field-IQ *Calibration* screen tap **Hydraulic Test**.

CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

2. Tap **Next**.
3. Enter the initial motor RPM. The default setting is 300. Trimble also recommends that you test the motor RPM at 100 to ensure that the drive runs smoothly at slow speeds.
4. Tap **Start**.

5. The next screen provides the status of each motor:



No Error – The test was successful.

Motor Stalled – The motors did not have sufficient oil flow; ensure the correct orifice size is installed for each motor. For more information, refer to the *Rawson System Installation Instructions*.

Disconnected – The Rawson Control Module cannot communicate with the motor.

6. Tap **Stop** to return to the Field-IQ *Calibration* screen.

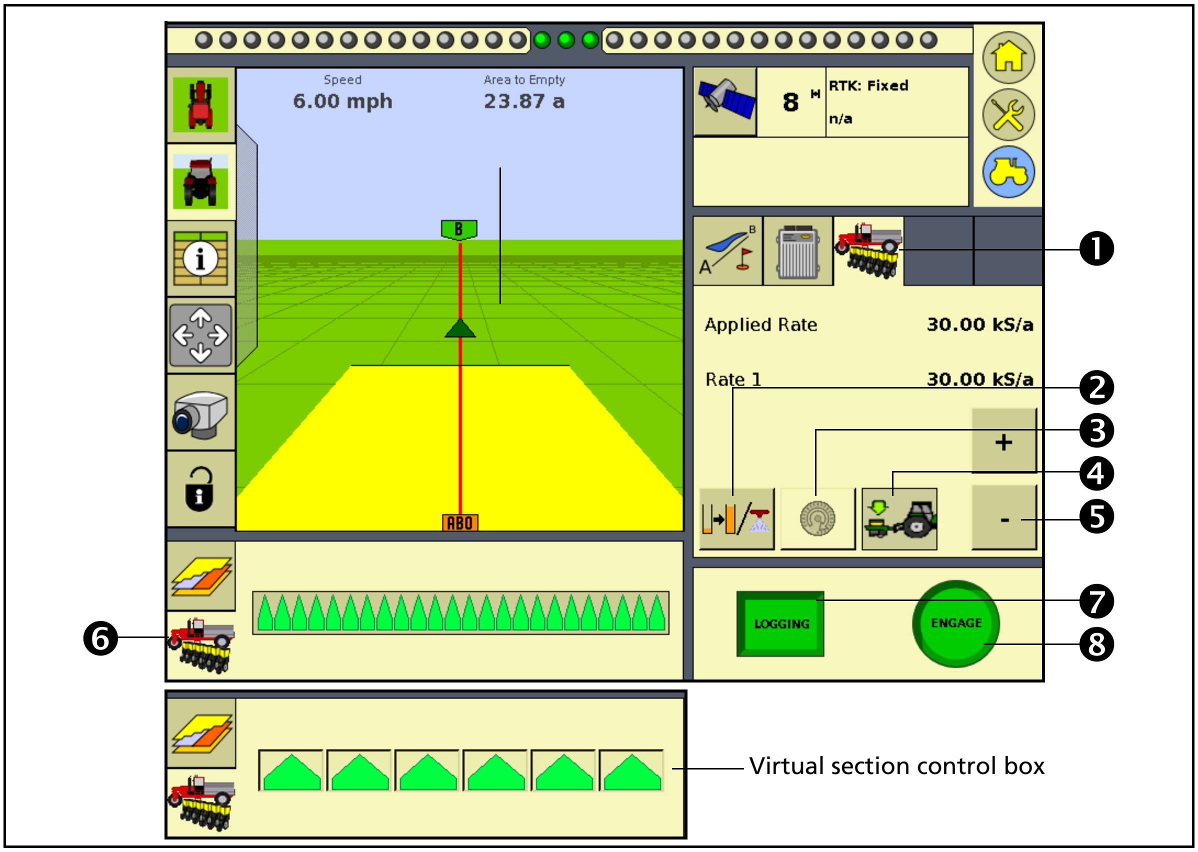
Calibrating the implement lift switch

1. From the *Field-IQ Calibration* screen, select the Implement Lift option.
2. Raise the implement and then tap **Next**.
3. Lower the implement and then tap **Next**.
4. Tap **OK** to return to the Field-IQ *Calibration* screen.

Operating in the field

1. From the Home screen, press .
2. From the *Current Configurations* screen, configure the display/vehicle/implement settings and then tap **OK**.
3. From the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

Planter Run screen



	Feature	Description
❶	Field-IQ Plugin tab	
❷	Tank/Bin button	Shows capacity, warning level, and current volume and access to the Refill Tank/Bin button.
❸	Fill Meter button	Turns the seed meter one revolution.
❹	Implement Switch Status	Green arrow down – Indicates the implement is lowered. Red arrow up – Indicates the implement is raised.
❺	Increase/Decrease buttons	Increases and decreases the application rate by the amount specified during setup.
❻	Field-IQ Status tab	Shows the engage status of each row on the implement. Green – Engaged. Gray – Section closed due to overlap. Red – Not engaged or section manually turned off.
❼	Logging button	Green – Logging enabled. Red – Logging.
❽	Engage button	Green – Auto guidance engaged. Gray – Auto guidance can be engaged. Red – Auto guidance cannot be engaged.

Field-IQ spraying with Servo or PWM control valves

Before starting the Field-IQ plugin setup on the FM-1000 integrated display, ensure that:

- all components of the system are installed on the vehicle and implement.
- the Field-IQ plugin has been added to the FM-1000 integrated display configuration.

  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Ensure that the Field-IQ icon appears in the list. If the icon does not appear, tap **Add/Remove** to add the plugin to the configuration.
- the Implement Setup has Strip Tillage as the selected operation.

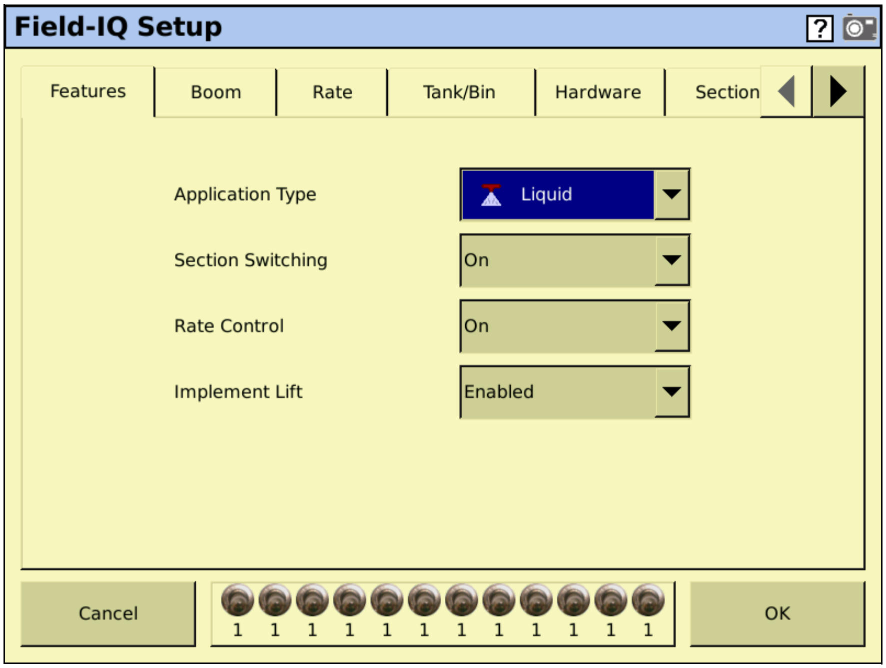
  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Select the implement from the list on the left and then tap **Setup**. The *Implement Setup* screen appears. In the *Operations* tab, select Spraying and then tap **OK**.

For more information about setting up the implement, see Chapter 7, Implement Configuration.

Field-IQ setup for spraying

1. From the Home screen, tap the  icon. The *Configuration Selection* screen appears.
2. Next to Implement, tap **Edit**. The *Configuration* screen appears.
3. Select Field-IQ and then tap **Setup**.

Features tab



1. In the *Application Type* drop-down list, ensure that Liquid is selected.
2. In the *Section Switching* drop-down list, select either On or Off.

   When On is selected, Automatic Section Control is active and at least one Field-IQ section control module must be installed.
3. In the *Rate Control* drop-down list, select either On or Off.

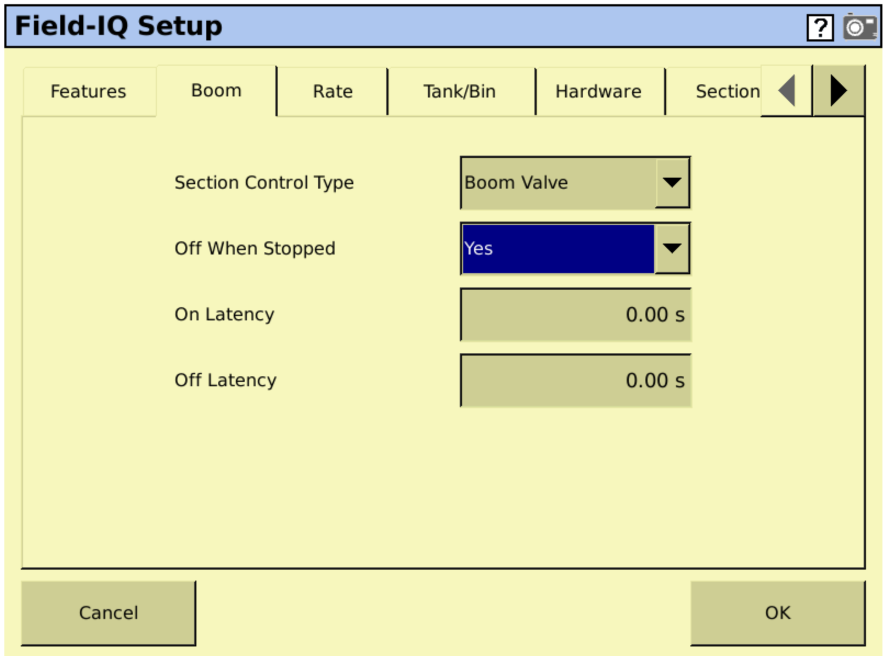
   When On is selected, Rate Control is active and at least one Field-IQ Rate and Section control module must be installed.
4. In the *Implement Lift* drop-down list, select either Enabled or Disabled.

   Select Enabled for the system to use the implement lift to start and stop coverage logging.

   Select Disabled for the system to ignore the implement lift switch (if installed). You can manually control coverage logging from the Run screen.

Boom tab

1. Select the *Boom* tab:



2. To control whether the system sends a high or a low signal to close a section valve, select one of the following options from the *Section Signal* drop-down list:

   – Reverse Polarity

   – Electric Clutch

   – Boom Valve

   – Liqui Block

CAUTION – Selecting the incorrect value causes the system to operate opposite of the required result.

3. In the *Turn Off When Stopped* drop-down list, select an option.

   Selecting Yes turns off sections when the GPS speed is zero.

4. In the *On Latency* field, enter a value.

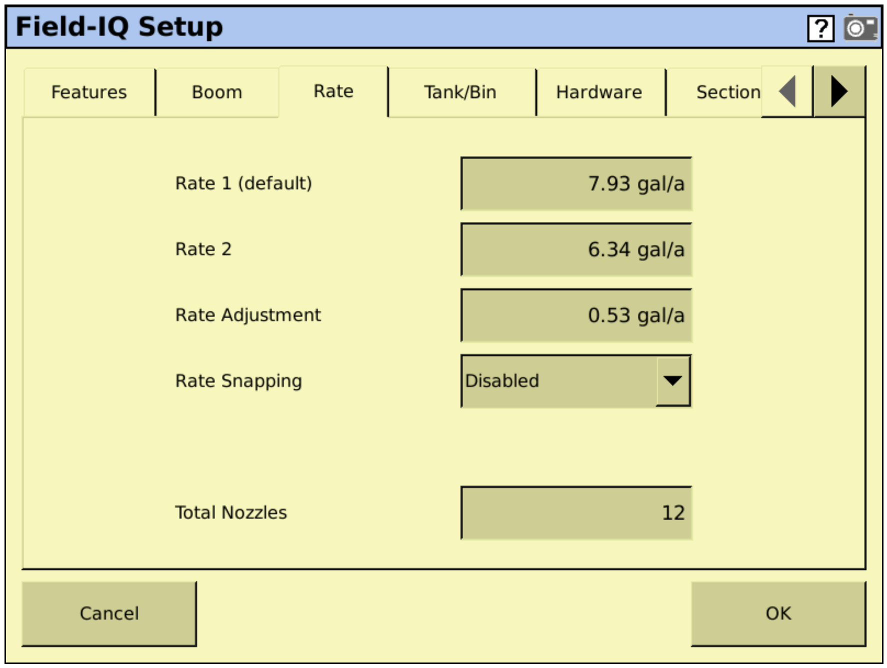
   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase the On Latency value to compensate the delay, and Field-IQ will turn on before they need to be turned on.

5. In the *Off Latency* field, enter a value.

By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase to compensate the delay, and Field-IQ will turn off before they need to be turned off.

Rate tab

1. Select the *Rate* tab:

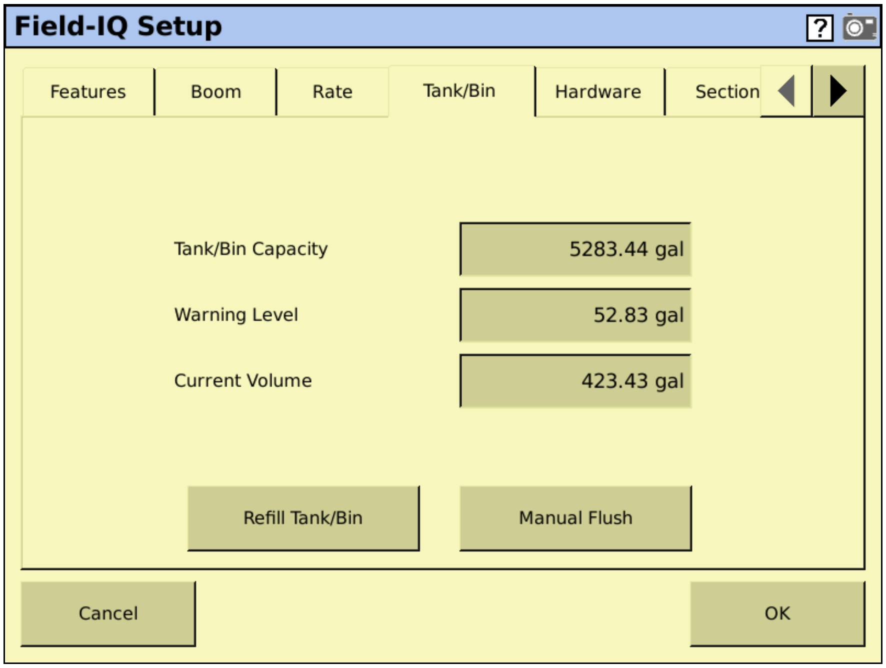


***Note** – The Rate tab is only visible if you have at least one Field-IQ Rate and Section control module installed.*

2. In the *Rate 1* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 1.
3. In the *Rate 2* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 2.
4. In the *Rate Increment* field, enter a value. This is the increment to be used each time the Increment/Decrement switch is pressed.
5. In the *Rate Snapping* drop-down list, select one of the following:
   - Enabled: to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate.
   - Disable: to show the actual applied value.
6. In the *Density* field, enter the density of the material you are applying.
   The system uses this value to ensure accurate product application. If you change the material, be certain to update this field with the correct material density.

Tank/Bin tab

1. Select the *Tank/Bin* tab:



***Note** – The Tank/Bin tab is only visible if at least one Field-IQ Rate and Section control module is installed.*

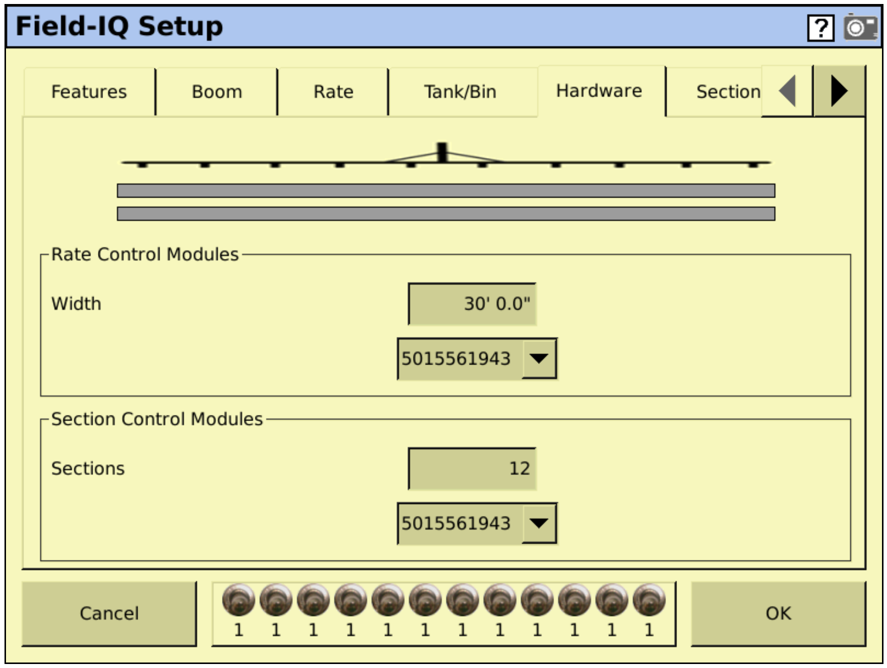
2. In the *Tank/Bin Capacity* field, enter the total capacity of the planter.
3. In the *Warning Level* field, enter the level at which you will receive notification when the capacity level drops below the assigned value.
4. In the *Current Volume* field, enter the current volume of the tank.

Tip – Tap **Refill Tank/Bin** to set the current volume to the tank/bin capacity.

Tip – To empty the tank/bin contents, tap **Manual Flush**. This enables the system to manually apply continuously without moving the implement.

Hardware tab

1. Select the *Hardware* tab:



***Note** – The numbers beneath each switch indicate the number of the sections assigned to that switch. So, switch 1 controls row 1, switch 2 controls row 2, switch 3 controls row 3, and so forth. You cannot change the numbers as they are automatically assigned. If you are not using the 12-section switch box, a "virtual" switch box with six sections is shown.*

***Note** – Modules appear in the order they are installed on the implement, viewed by standing behind the implement and looking in the general direction of travel.*

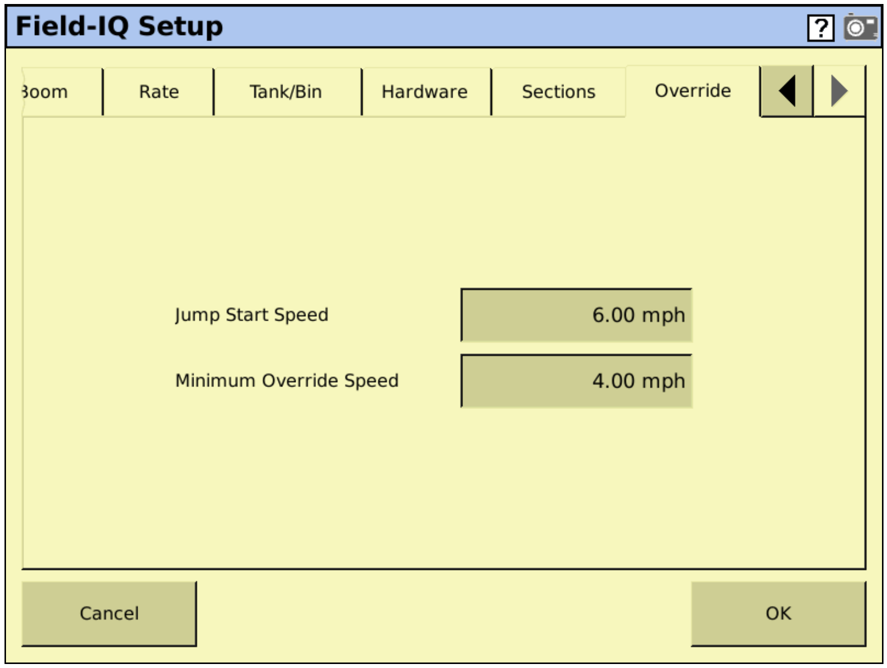
Tip – To change the order of the modules on the *Hardware* tab, tap the icon of the module you want to move and then tap the directional arrows to move the icon.

2. Adjust the width value for each rate control module by tapping the *Width* box. Enter the appropriate value and then tap **OK**.

3. Adjust the sections value for each Rate and Section control module by tapping the *Sections* box. Enter the appropriate value and then tap **OK**.

Override tab

1. Select the *Override* tab:



2. In the *Jump Start Speed* field, enter a value.

   This setting controls the control speed to be used when the Field-IQ master switch box Master switch is put in the jump start position.

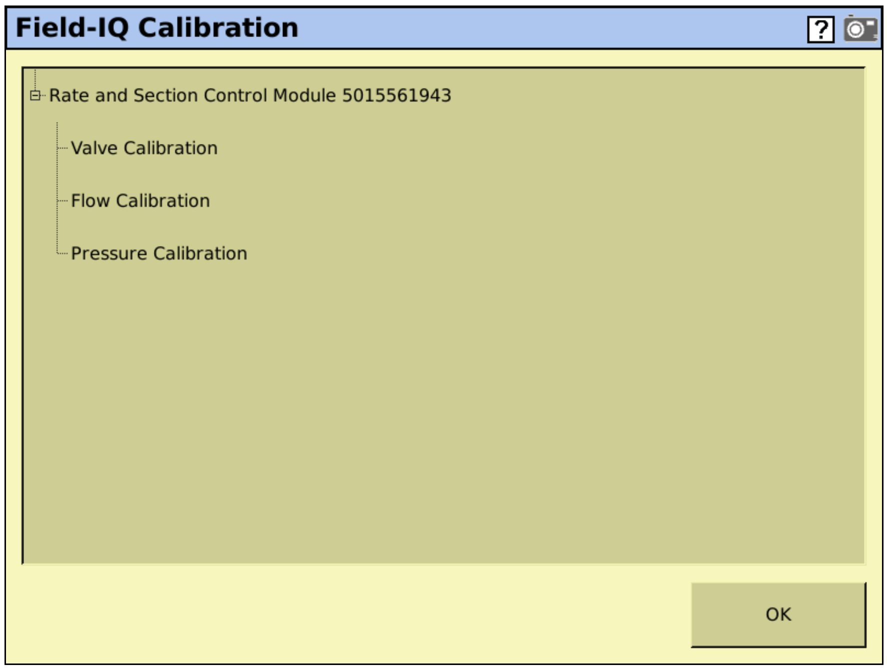
3. In the *Minimum Override Speed* field, enter a value.

   This setting maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds that may reach the physical limitations of the system.

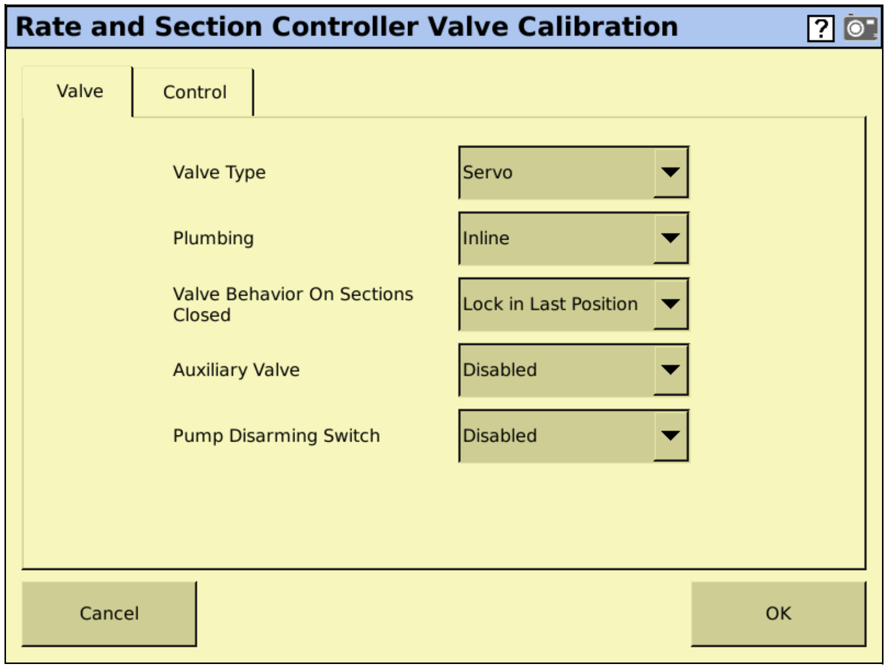
Calibrating the modules

The Field-IQ *Calibrate* option only appears on the *Configuration* screen if you have at least one Field-IQ Rate and Section control module installed.

1. From the *Configuration* screen, select the Field-IQ plugin and then tap **Calibrate**.
2. From the *Field-IQ Calibration* screen, select the Rate and Section Control Module to be calibrated. The message Not calibrated appears at the end of the modules that need calibration.
3. Select *Valve Calibration*. The following screen appears:



4. Tap *Valve Calibration*. The following screen appears:

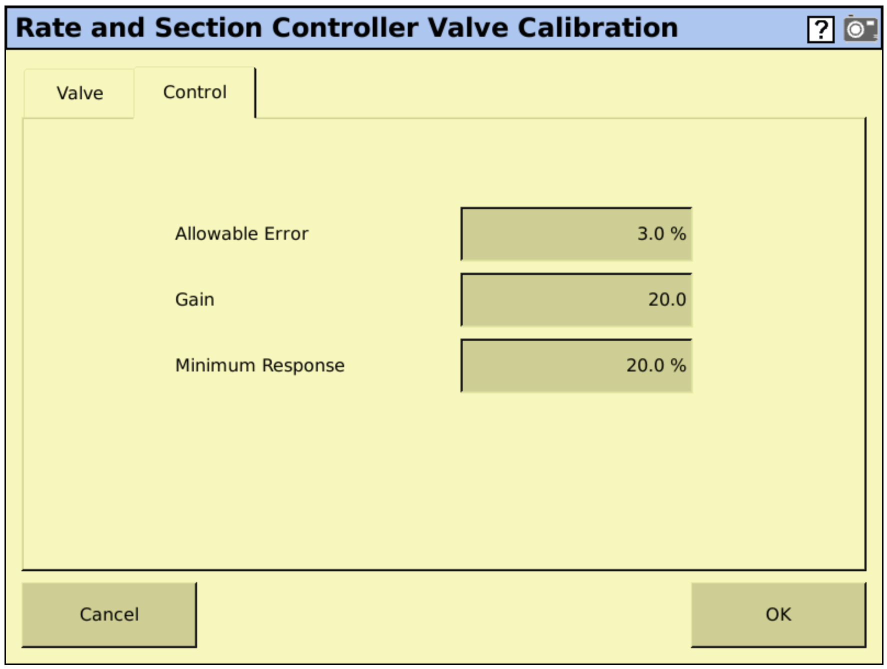


5. Select the *Valve* tab, and then select the appropriate value for each field:

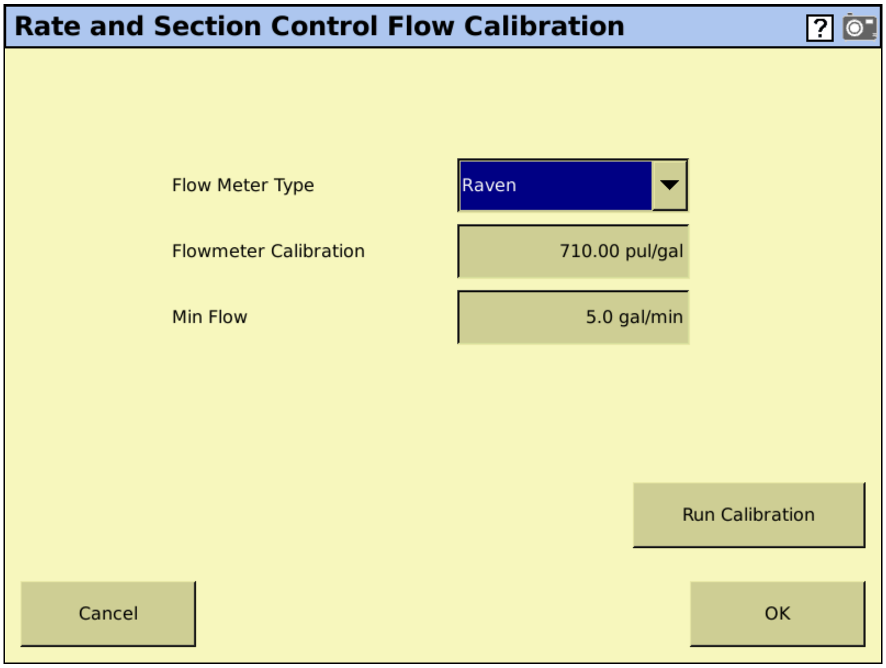
For this field ...	Select one of the following options ...
Valve Type	***Pump Servo***: The Pump Servo setting controls an electric motor which actuates a hydraulic valve. As the valve actuates, it adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***PWM***: The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***Fast Servo***: 4 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a DICKEY-john servo, Mid-Tech servo, or Raven Fast Valve ***Servo***: 2 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a Raven standard servo. ***Hardi % bypass scenario***: Most commonly used on Hardi sprayers equipped with 3 way section valves that return flow to tank when the boom section is off.
Plumbing	***Inline***: Valve is in the solution line going to the boom. The valve opens to increase application rate. ***Bypass***: Valve is in the Return to Tank line. The valve closes to increase the application rate.
Valve Behavior on Sections Closed	***Close***: When all sections are off, the control valve returns to the closed position. ***Lock in Last Position***: When all sections are off, the control valve remains in the last position. This setting allows the system to return to the target rate faster.
Auxiliary Valve	If you have an Auxiliary Valve installed, select one of the following: ***Master***: Valve closes when the system is turned off. ***Dump***: Valve opens to dump flow to return line when the system is turned off.
Pump Disarming Switch	***Enable***: Select this option if you have a Pump Disarming Switch installed.

6. Select the *Control* tab. Enter a value for each of the following:
   – Allowable Error
   – Gain
   – Minimum Response

***Note** – For information about the appropriate values for your sprayer, see the Getting Started Guide*



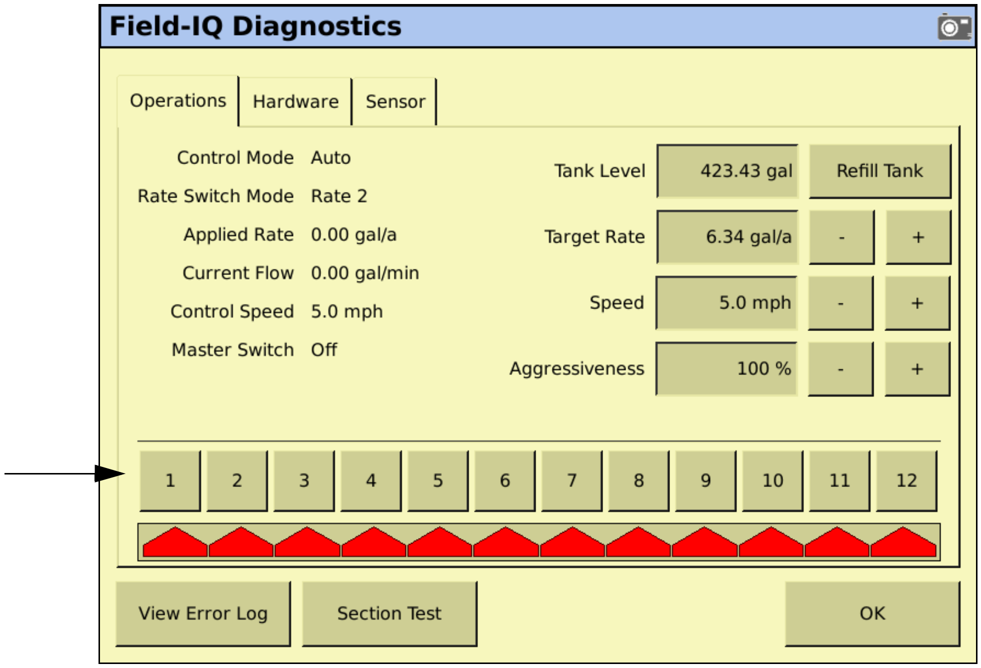
7. Tap **OK** to return to the main calibration screen, and then tap *Flow Calibration*. The following screen appears:



CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

8. Tap **OK**. Enter a value for each of the following:
   - *Flow Meter Type*: select an option from the drop-down list.
   - *Flowmeter Calibration*: enter the number from the flow meter tag
   - *MinFlow*: enter the required minimum flow rate for the system. Use this setting to keep the control valve and flow meter above the minimum operating level.
9. Tap **Run Calibration**, and then follow the on-screen instructions.
10. If used, select the connector that the pressure sensor is connected to, and then enable the sensor.
11. Tap **Run Calibration**, and then follow the on-screen instructions.
12. Tap **OK** to return to the *Configuration* screen.

13. Select the *Field-IQ plugin* tab and then tap *Diagnostics.* The following screen appears:



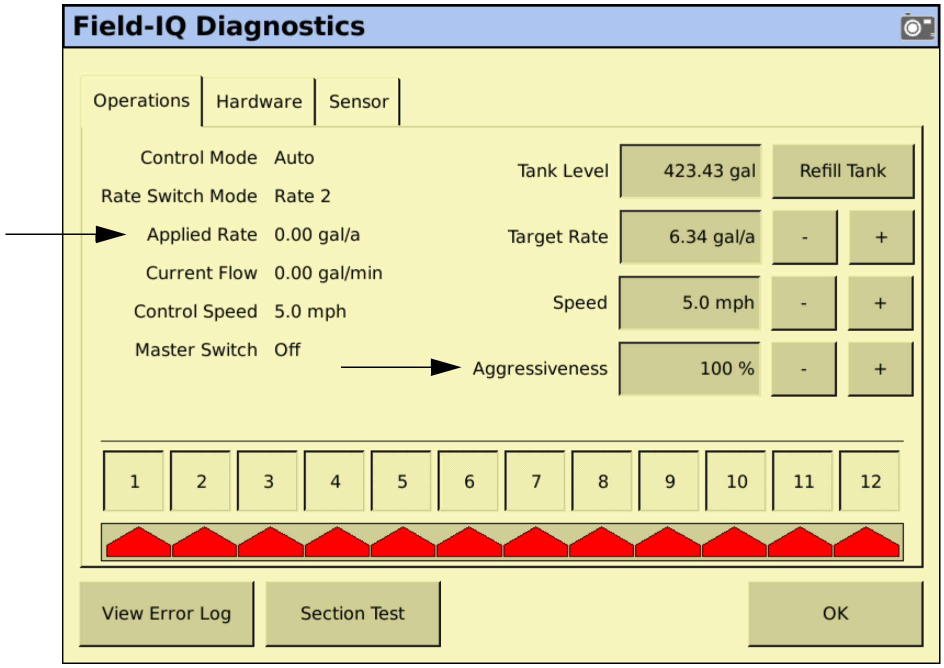
14. To enable the sections, tap the numbered section tabs above each of the section icons.

15. Enter a value for each of the following:

    – *Target Rate*: The required rate for the rate switch

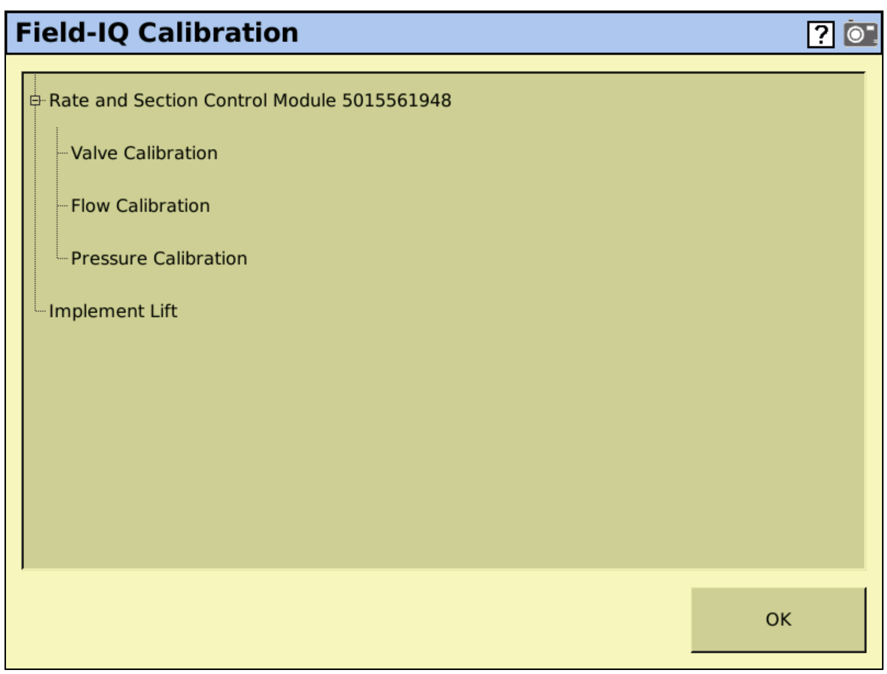
    – *Speed*

16. Operate the sprayer, and check value shown for the *Applied Rate*. If necessary, adjust the *Aggressiveness* setting to achieve the desired rate.



Calibrating the implement lift switch

1. From the *Field-IQ Calibration* screen, select the *Implement Lift* option:



2. Tap **OK**.

3. Raise the implement and then tap **Next**.
4. Lower the implement and then tap **Next**.
5. Tap **OK** to return to the Field-IQ *Calibration* screen.

Operating in the field

1. From the Home screen, press .
2. From the *Configurations SElection* screen, configure the display/vehicle/implement settings and then tap **OK**.
3. From the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

Field-IQ Liquid Strip Till with PWM or Servo control valve

Before starting the Field-IQ plugin setup on the FM-1000 integrated display, ensure that:

- all components of the system are installed on the vehicle and implement.
- the Field-IQ plugin has been added to the FM-1000 integrated display configuration.

  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Ensure that the Field-IQ icon appears in the list. If the icon does not appear, tap **Add/Remove** to add the plugin to the configuration.
- the Implement Setup has Strip Tillage as the selected operation.

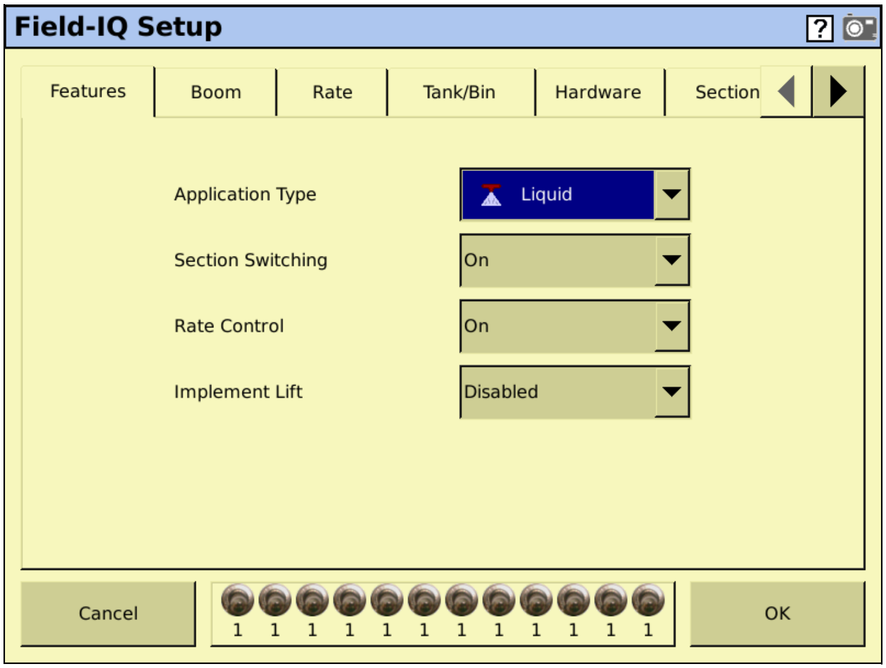
  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Select the implement from the list on the left and then tap **Setup**. The *Implement Setup* screen appears. In the *Operations* tab, select Strip Till and then tap **OK**.

For more information about setting up the implement, see Chapter 7, Implement Configuration.

Field-IQ setup for Liquid Strip Till with PWM or Servo control valve

1. From the Home screen, tap the  icon. The *Configuration Selection* screen appears.
2. Next to Implement, tap **Edit**. The *Configuration* screen appears.
3. Select Field-IQ and then tap **Setup**.

Features tab



1. In the *Application Type* drop-down list, ensure that Liquid is selected.
2. In the *Boom Switching* drop-down list, select either On or Off.

   When On is selected, Automatic Section Control is active and at least one Field-IQ section control module must be installed.
3. In the *Rate Control* drop-down list, select either On or Off.

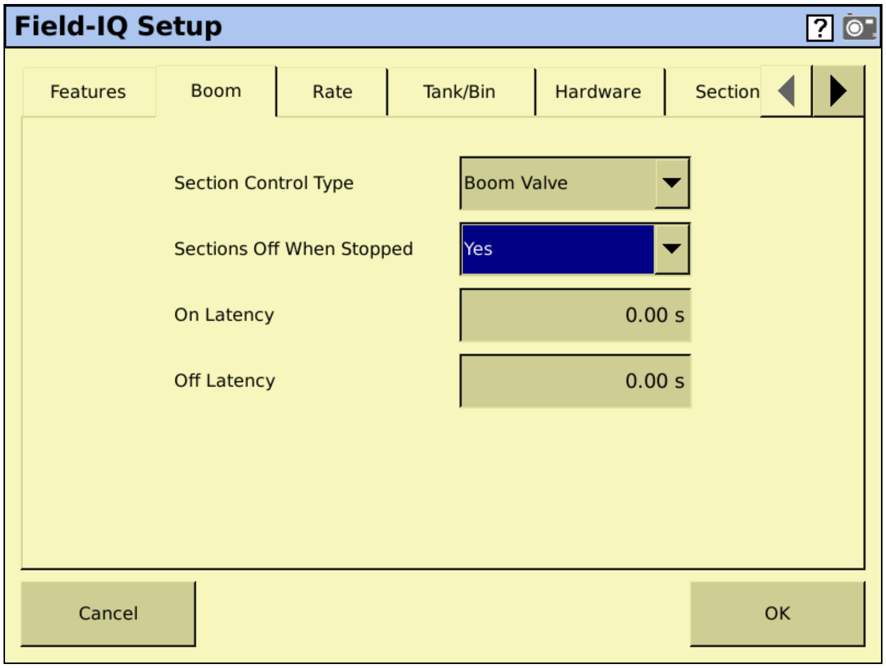
   When On is selected, Rate Control is active and at least one Field-IQ Rate and Section control module must be installed.
4. In the *Implement Lift* drop-down list, select either Enabled or Disabled.

   Select Enabled for the system to use the implement lift to start and stop coverage logging.

   Select Disabled for the system to ignore the implement lift switch (if installed). You can manually control coverage logging from the Run screen.

Boom tab

1. Select the *Boom* tab:



2. To control whether the system sends a high or a low signal to close a section valve, select one of the following options from the *Section Signal* drop-down list:

   – Reverse Polarity

   – Electric Clutch

   – Boom Valve

   – Liqui Block

CAUTION – Selecting the incorrect value causes the system to operate opposite of the required result.

3. In the *Turn Off When Stopped* drop-down list, select an option.

   Selecting Yes turns off sections when the GPS speed is zero.

4. In the *On Latency* field, enter a value.

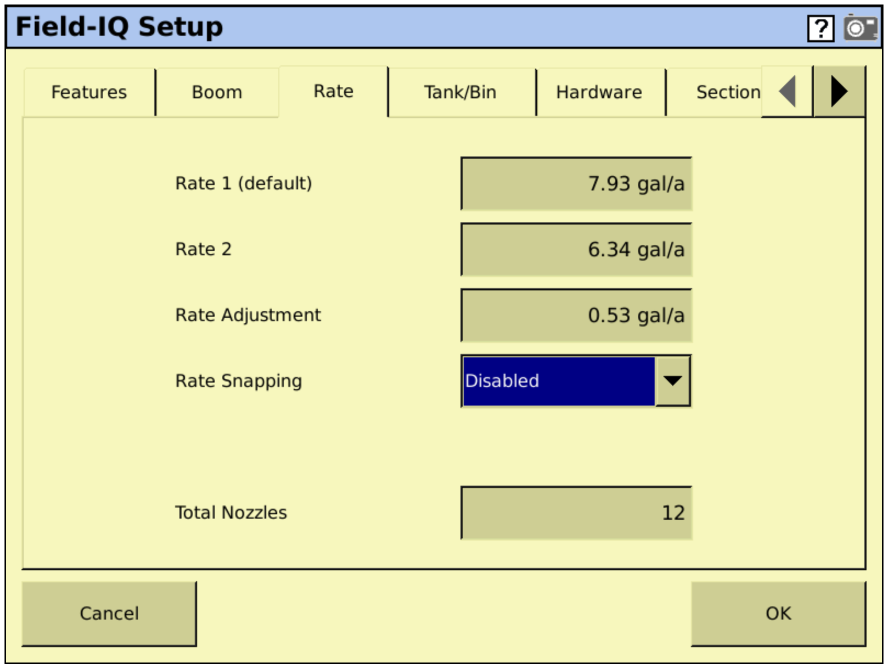
   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase the On Latency value to compensate the delay, and Field-IQ will turn on before they need to be turned on.

5. In the *Off Latency* field, enter a value.

By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase to compensate the delay, and Field-IQ will turn off before they need to be turned off.

Rate tab

1. Select the *Rate* tab:

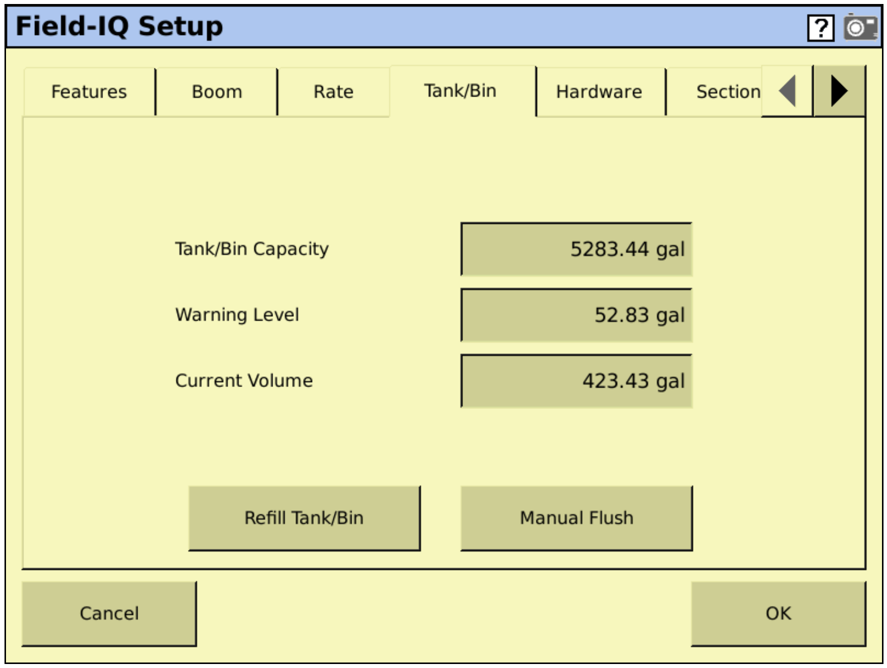


Note – *The Rate tab is only visible if you have at least one Field-IQ Rate and Section control module installed.*

2. In the *Rate 1* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 1.
3. In the *Rate 2* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 2.
4. In the *Rate Increment* field, enter a value. This is the increment to be used each time the Increment/Decrement switch is pressed.
5. In the *Rate Snapping* drop-down list, select one of the following:
   - Enabled: to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate.
   - Disable: to show the actual applied value.
6. In the *Total Nozzles* field, enter the total number of nozzles on the boom. Make sure that you enter the correct number, as the display uses this value when it calibrates system.

Tank/Bin tab

1. Select the *Tank/Bin* tab:



Note *– The Tank/Bin tab is only visible if at least one Field-IQ Rate and Section control module is installed.*

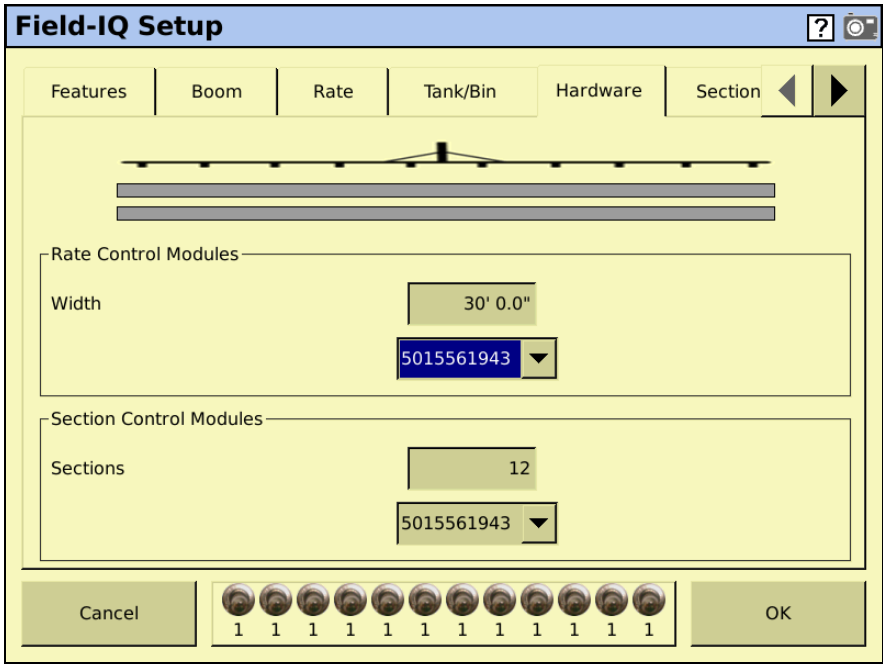
2. In the *Tank/Bin Capacity* field, enter the total capacity of the planter.
3. In the *Warning Level* field, enter the level at which you will receive notification when the capacity level drops below the assigned value.
4. In the *Current Volume* field, enter the current volume of the tank.

Tip – Tap **Refill Tank/Bin** to set the current volume to the tank/bin capacity.

Tip – To empty the tank/bin contents, tap **Manual Flush**. This enables the system to manually apply continuously without moving the implement.

Hardware tab

1. Select the *Hardware* tab:



***Note** – The numbers beneath each switch indicate the number of the sections assigned to that switch. So, switch 1 controls section 1, switch 2 controls section 2, switch 3 controls section 3, and so forth. You cannot change the numbers as they are automatically assigned. If you are not using the 12-section switch box, a "virtual" switch box with six sections is shown.*

***Note** – Modules appear in the order they are installed on the implement, viewed by standing behind the implement and looking in the general direction of travel.*

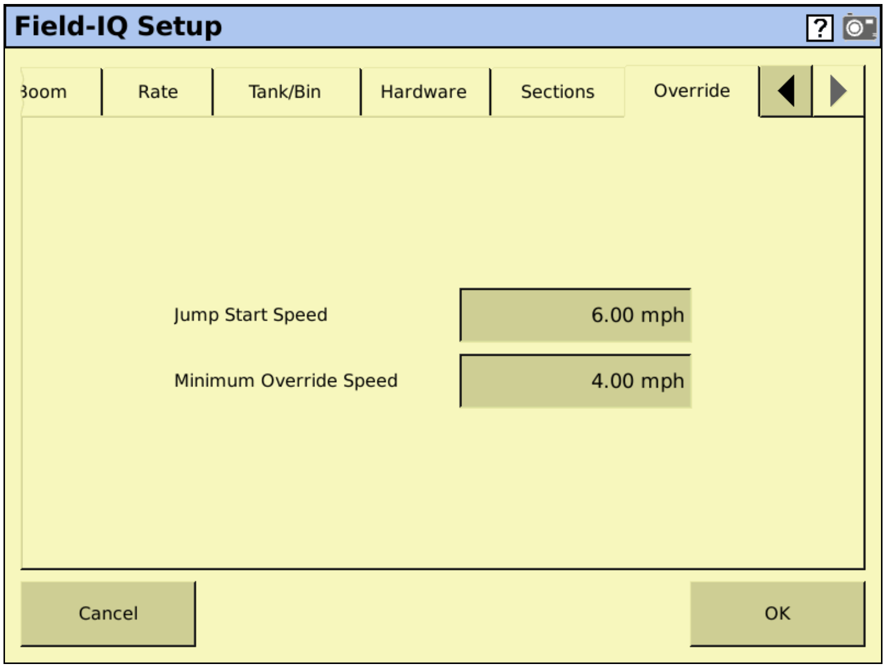
Tip – To change the order of the modules on the *Hardware* tab, tap the icon of the module you want to move and then tap the directional arrows to move the icon.

2. Adjust the width value for each rate control module by tapping the *Width* box. Enter the appropriate value and then tap **OK**.

3. Adjust the sections value for each Rate and Section control module by tapping the *Sections* box. Enter the appropriate value and then tap **OK**.

Override tab

1. Select the *Override* tab:



2. In the *Jump Start Speed* field, enter a value.

   This setting controls the control speed to be used when the Field-IQ master switch box Master switch is put in the jump start position.

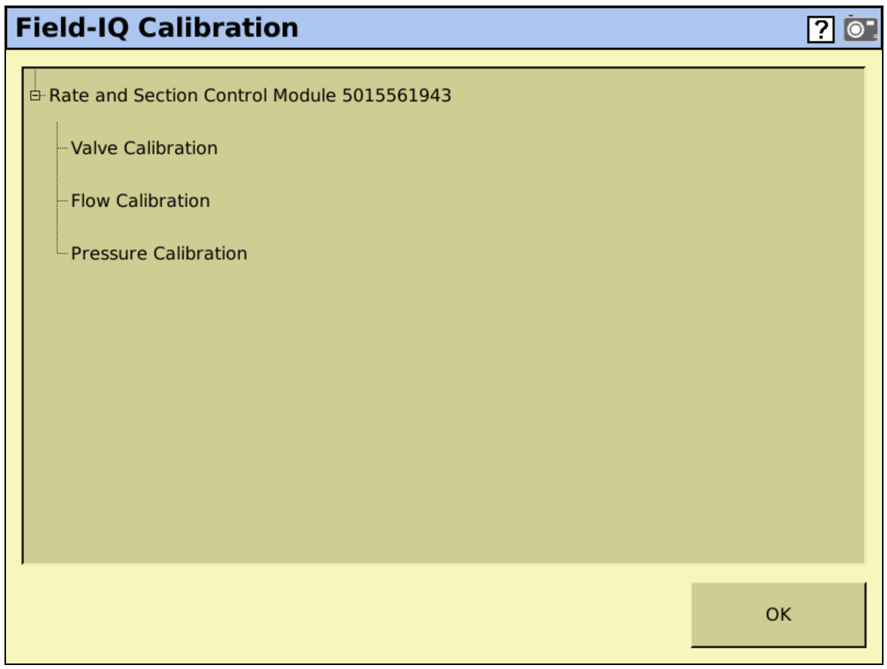
3. In the *Minimum Override Speed* field, enter a value.

   This setting maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds that may reach the physical limitations of the system.

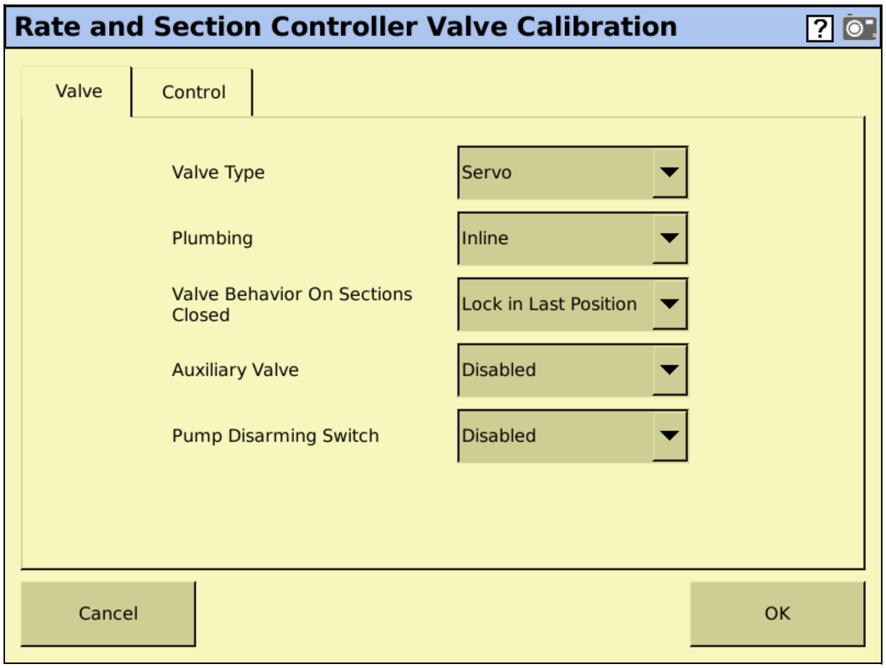
Calibrating the modules

The Field-IQ *Calibrate* option only appears on the *Configuration* screen if you have at least one Field-IQ Rate and Section control module installed.

1. From the *Configuration* screen, select the Field-IQ plugin and then tap **Calibrate**.
2. From the *Field-IQ Calibration* screen, select the Rate and Section Control Module to be calibrated. The message Not calibrated appears at the end of the modules that need calibration.
3. Select *Valve Calibration*. The following screen appears:



4. Tap *Valve Calibration*. The following screen appears:

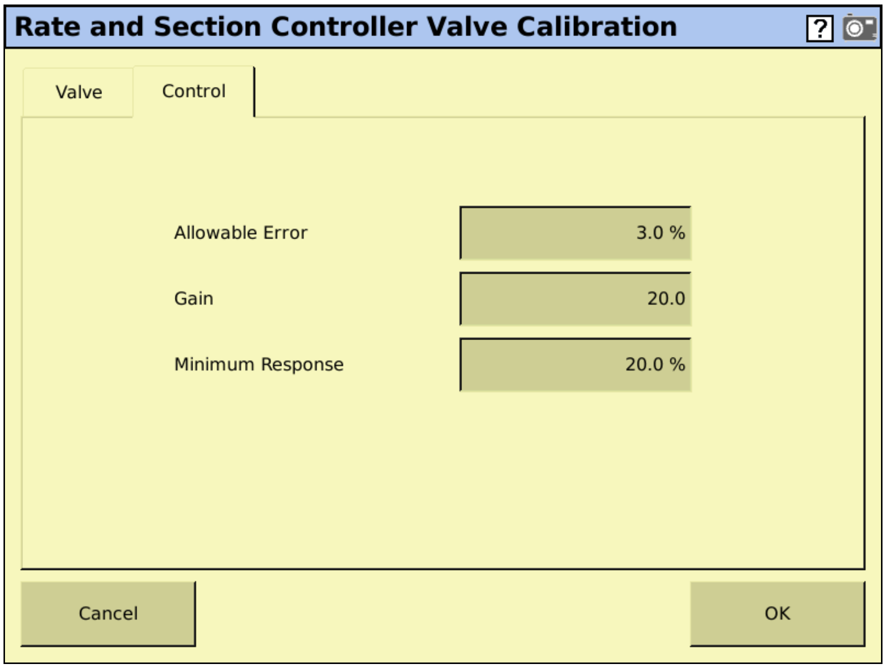


5. Select the *Valve* tab, and then select the appropriate value for each field:

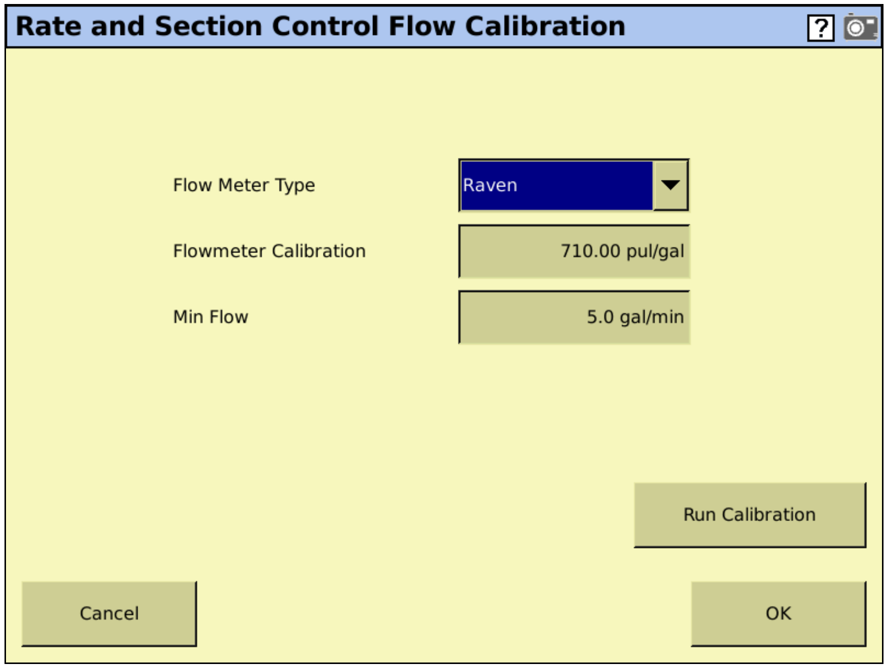
For this field ...	Select one of the following options ...
Valve Type	***Pump Servo***: The Pump Servo setting controls an electric motor which actuates a hydraulic valve. As the valve actuates, it adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***PWM***: The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***Fast Servo***: 4 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a DICKEY-john servo, Mid-Tech servo, or Raven Fast Valve ***Servo***: 2 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a Raven standard servo. ***Hardi % bypass scenario***: Most commonly used on Hardi sprayers equipped with 3 way section valves that return flow to tank when the boom section is off.
Plumbing	***Inline***: Valve is in the solution line going to the boom. The valve opens to increase application rate. ***Bypass***: Valve is in the Return to Tank line. The valve closes to increase the application rate.
Valve Behavior on Sections Closed	***Close***: When all sections are off, the control valve returns to the closed position. ***Lock in Last Position***: When all sections are off, the control valve remains in the last position. This setting allows the system to return to the target rate faster.
Auxiliary Valve	If you have an Auxiliary Valve installed, select one of the following: ***Master***: Valve closes when the system is turned off. ***Dump***: Valve opens to dump flow to return line when the system is turned off.
Pump Disarming Switch	***Enable***: Select this option if you have a Pump Disarming Switch installed.

6. Select the *Control* tab. Enter a value for each of the following:
   – Allowable Error
   – Gain
   – Minimum Response

Note *– For information about the appropriate values for your sprayer, see the Getting Started Guide*



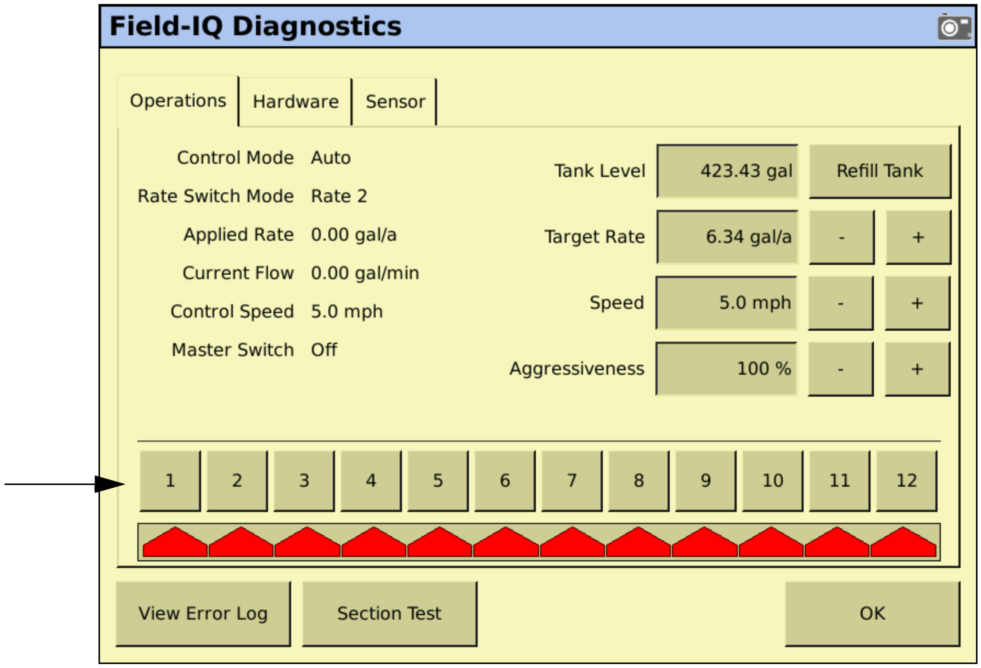
7. Tap **OK** to return to the main calibration screen, and then tap *Flow Calibration*. The following screen appears:



CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

8. Tap **OK**. Enter a value for each of the following:
   – *Flow Meter Type*: select an option from the drop-down list.
   – *Flowmeter Calibration*: enter the number from the flow meter tag
   – *MinFlow*: enter the required minimum flow rate for the system. Use this setting to keep the control valve and flow meter above the minimum operating level.
9. Tap **Run Calibration**, and then follow the on-screen instructions.
10. If used, select the connector that the pressure sensor is connected to, and then enable the sensor.
11. Tap **Run Calibration**, and then follow the on-screen instructions.
12. Tap **OK** to return to the *Configuration* screen.

13. Select the *Field-IQ plugin* tab and then tap *Diagnostics.* The following screen appears:



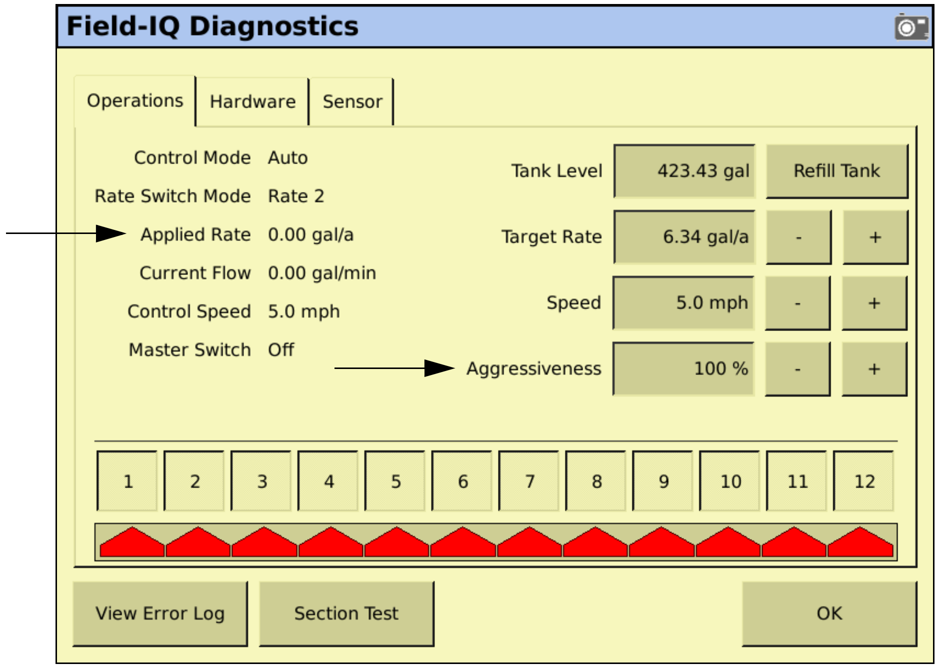
14. To enable the sections, tap the numbered section tabs above each of the section icons.

15. Enter a value for each of the following:

   – *Target Rate*: The required rate for the rate switch

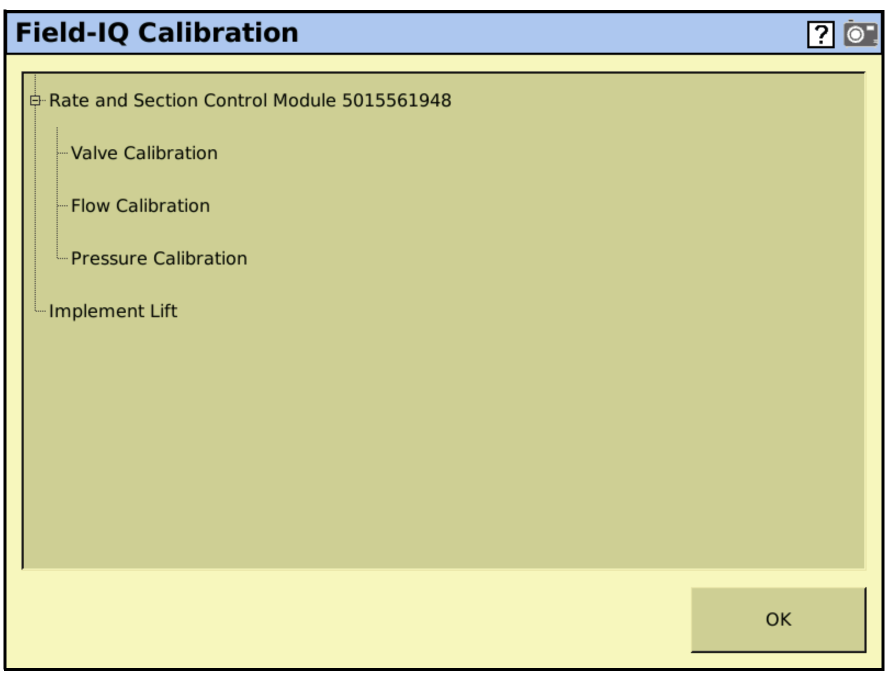
   – *Speed*

16. Operate the sprayer, and check value shown for the *Applied Rate*. If necessary, adjust the *Aggressiveness* setting to achieve the desired rate.



Calibrating the implement lift switch

1. From the *Field-IQ Calibration* screen, select the Implement Lift option:



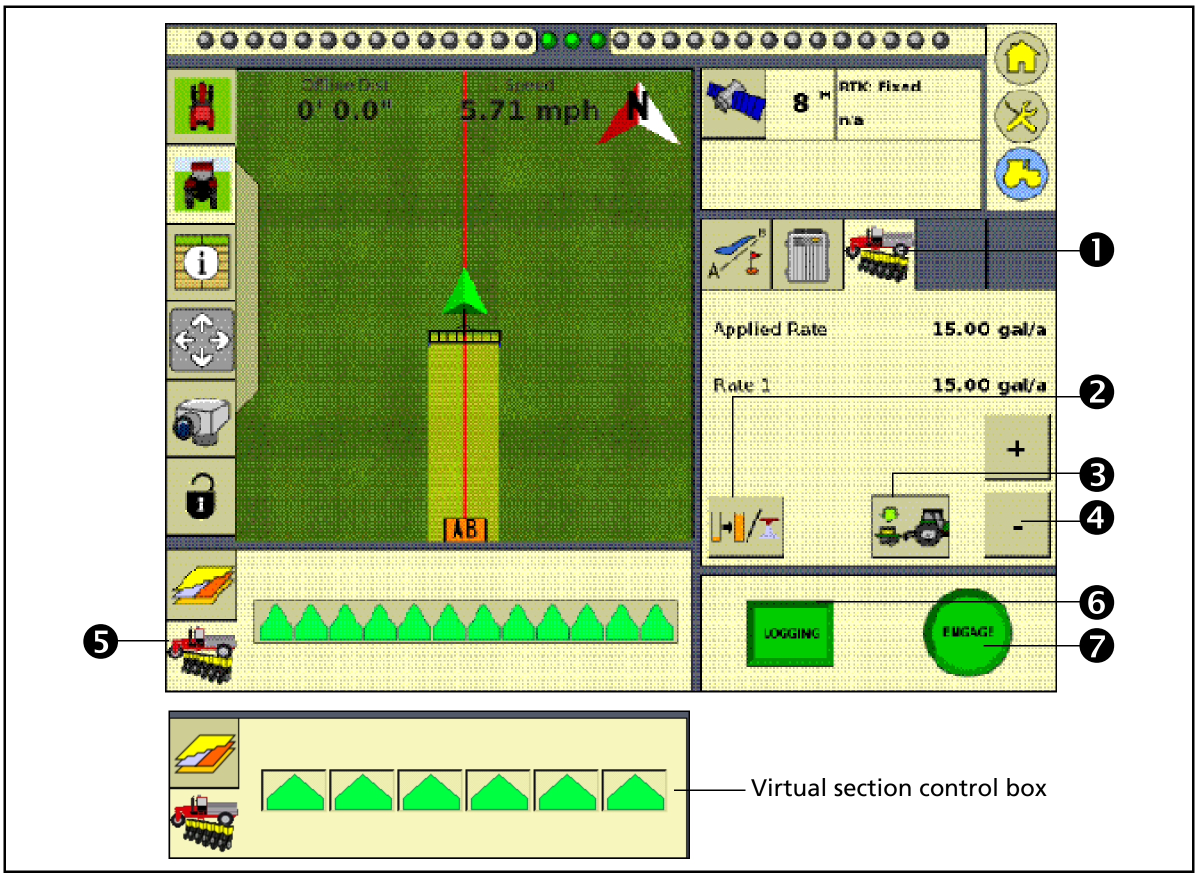
2. Tap **OK**.

3. Raise the implement and then tap **Next**.
4. Lower the implement and then tap **Next**.
5. Tap **OK** to return to the Field-IQ *Calibration* screen.

Operating in the field

1. From the Home screen, press .
2. From the *Configuration Selection* screen, configure the display/vehicle/implement settings and then tap **OK**.
3. From the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

Liquid Strip Tillage Run screen



	Feature	Description
❶	Field-IQ Plugin tab	
❷	Tank/Bin button	Shows capacity, warning level, and current volume and access to the Refill Tank/Bin button.

	Feature	Description
❸	Implement Switch Status	Green arrow down – Indicates the implement is lowered. Red arrow up – Indicates the implement is raised.
❹	Increase/Decrease buttons	Increases and decreases the application rate by the amount specified during setup.
❺	Field-IQ Status tab	Shows the engage status of each row on the implement. Green – Engaged. Gray – Section closed due to overlap. Red – Not engaged or section manually turned off.
❻	Logging button	Green – Logging enabled. Red – Logging.
❼	Engage button	Green – Auto guidance engaged. Gray – Auto guidance can be engaged. Red – Auto guidance cannot be engaged.

Field-IQ Spinner Spreading for PWM / Servo control valves

Before starting the Field-IQ plugin setup on the FM-1000 integrated display, ensure:

- all components of the system are installed on the vehicle and implement.
- the Field-IQ plugin has been added to the FM-1000 integrated display configuration.

  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Ensure that the Field-IQ icon appears in the list. If the icon does not appear, tap **Add/Remove** to add the plugin to the configuration.
- the Implement Setup has Spreading as the selected operation.

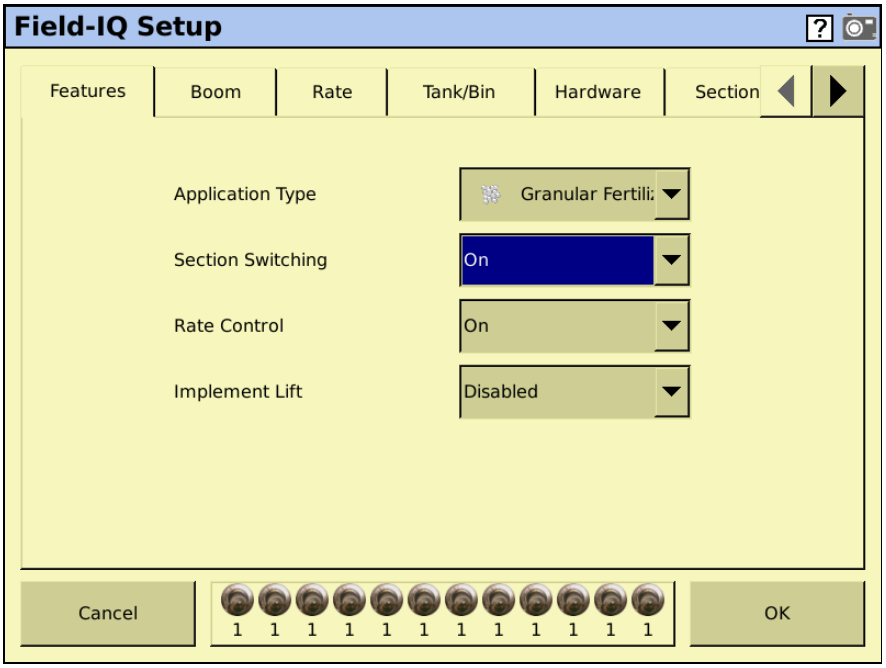
  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Select the implement from the list and then tap **Setup**. The *Implement Setup* screen appears. In the *Operations* tab, select Spreading.

For more information about setting up the implement, see Chapter 7, Implement Configuration.

Field-IQ for spinner spreading with PWM and Servo control valves

1. From the Home screen, tap the  icon. The *Configuration Selection* screen appears.
2. Next to Implement, tap **Edit**. The *Configuration* screen appears.
3. Select the Field-IQ plugin and then tap **Setup**.

Features tab



1. In the *Application Type* field, select Granular Fertilizer.
2. In the *Boom Switching* drop-down list, select either On or Off.

   When On is selected, Automatic Section Control is active and at least one Field-IQ section control module must be installed.
3. In the *Rate Control* drop-down list, select either On or Off.

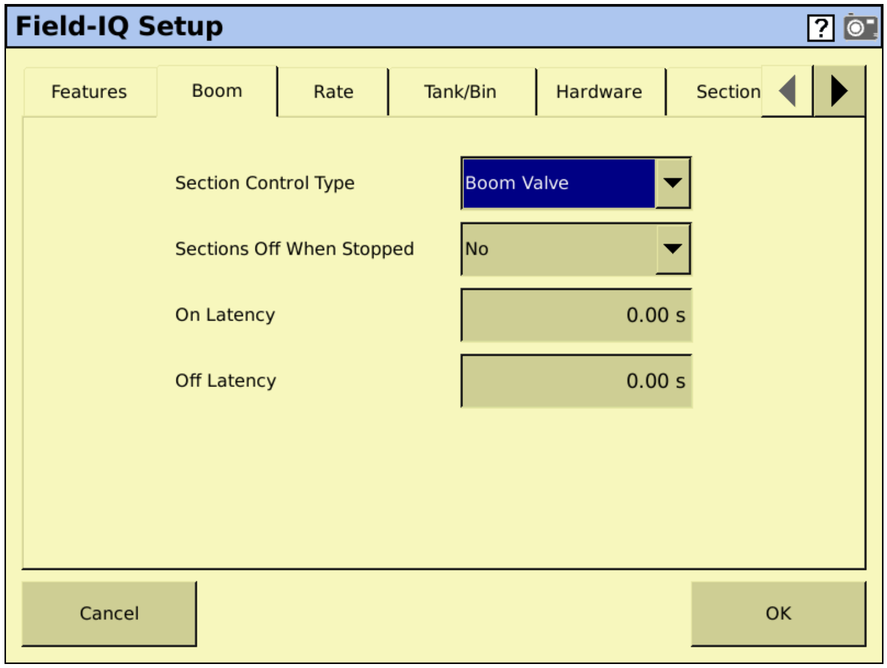
   When On is selected, Rate Control is active and at least one Field-IQ Rate and Section control module must be installed.
4. The *Implement Lift* drop-down list is not commonly used with spreaders. Leave this option set to Disabled.

   Select Enabled for the system to use the implement lift to start and stop coverage logging.

   Select Disabled for the system to ignore the implement lift switch (if installed). You can manually control coverage logging from the Run screen.

Boom tab

1. Select the *Boom* tab:



2. To control whether the system sends a high or a low signal to close a section valve, select one of the following options from the *Section Signal* drop-down list:
   - Air Clutch
   - Electric Clutch
   - Boom Valve
   - Liqui Block

CAUTION – Selecting the incorrect value causes the system to operate opposite of the required result.

3. In the *Turn Off When Stopped* drop-down list, select an option.

   Selecting Yes turns off sections when the GPS speed is zero.

4. In the *On Latency* field, enter a value.

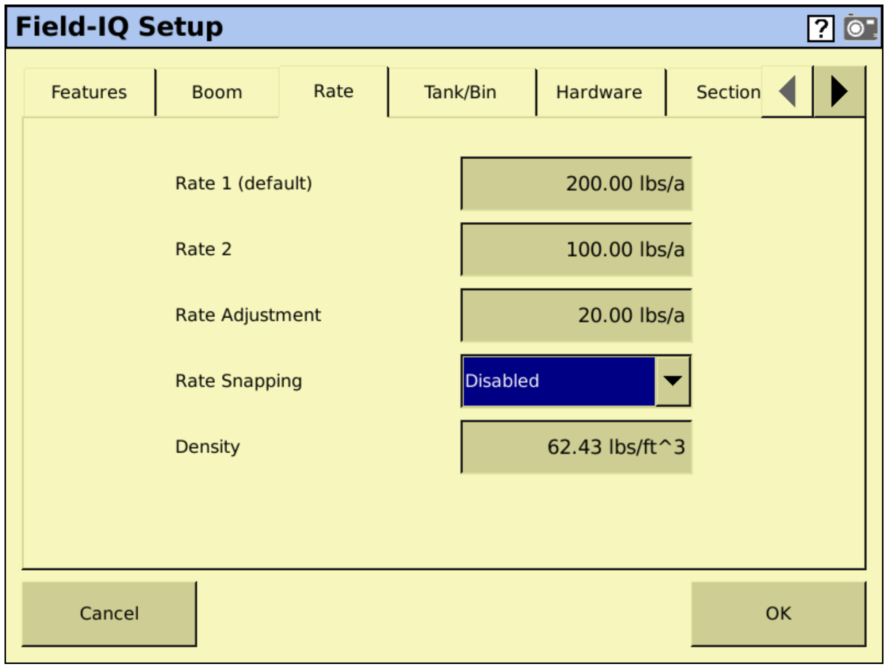
   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch (this can happen on larger systems). In this case, increase the On Latency value to compensate the clutch delay, and Field-IQ will turn the clutches on before they need to be turned on.

5. In the *Off Latency* field, enter a value.

By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch (this can happen on larger systems). In this case, increase to compensate the clutch delay, and Field-IQ will turn the clutches off before they need to be turned off.

Rate tab

1. Select the *Rate* tab:



***Note** – The Rate tab is only visible if you have at least one Field-IQ Rate and Section control module installed.*

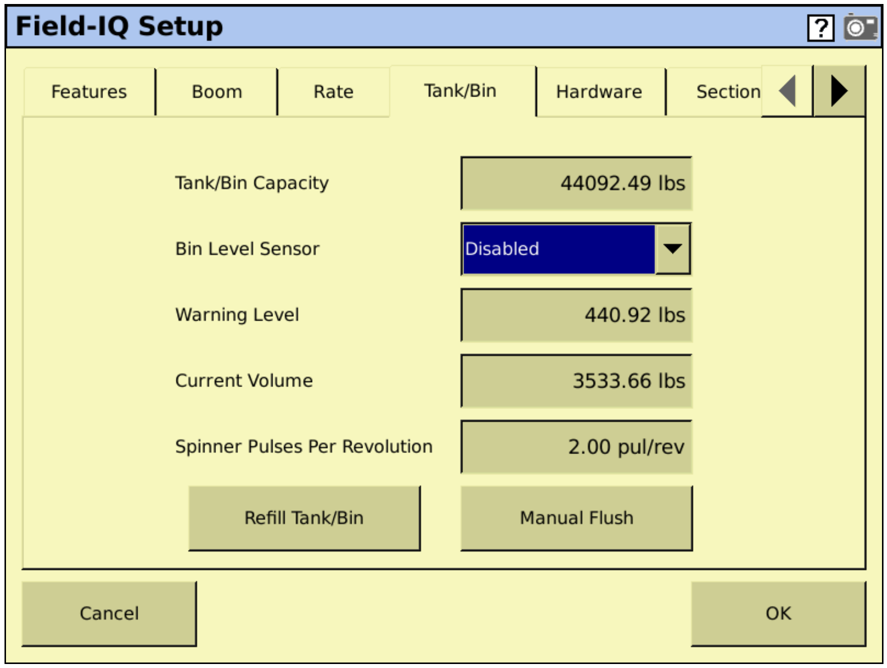
2. In the *Rate 1* field, enter a value. This is the application rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 1.
3. In the *Rate 2* field, enter a value. This is the application rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 2.
4. In the *Rate Increment* field, enter a value. This is the increment to be used each time the Increment/Decrement switch is pressed.
5. In the *Rate Snapping* drop-down list, select an option.

   Select Enabled to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate.

   Select Disabled to show the actual applied value.
6. In the Density field, enter the density of the material that you are applying. Note that the system uses this value to ensure accurate product application. If you change the material, make sure that you update this field with the correct material density.

Tank/Bin tab

1. Select the *Tank/Bin* tab:



***Note** – The Tank/Bin tab is only visible if at least one Field-IQ Rate and Section control module is installed.*

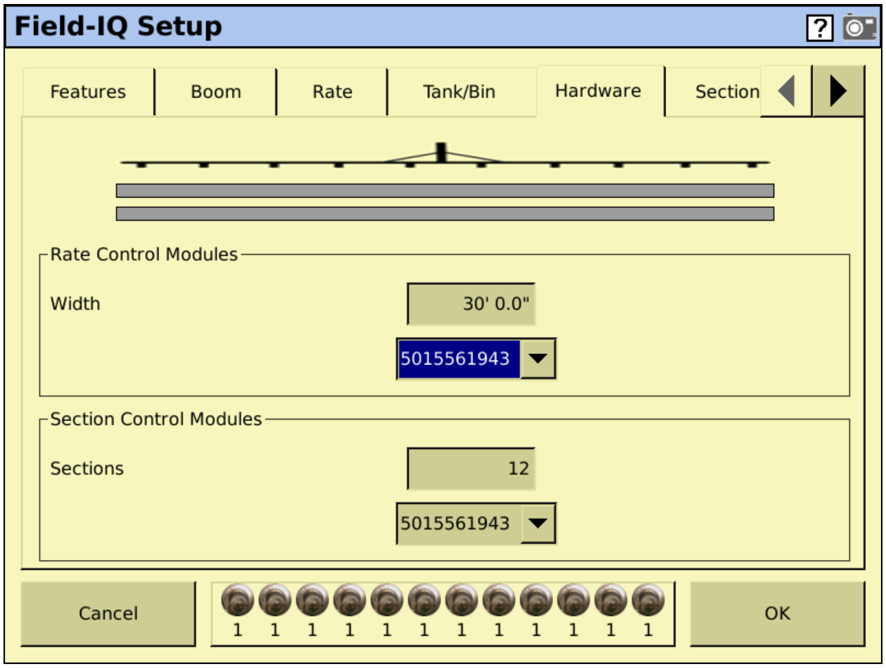
2. In the *Tank/Bin Capacity* field, enter the total capacity of the spreader.
3. In the *Warning Level* field, enter the level at which you will receive notification when the capacity level drops below the assigned value.
4. In the *Current Volume* field, enter the current volume of the tank.
5. If you have a spinner speed sensor installed, enter the calibration factor into the *Spinner Pulses Per Revolution* field,

Tip – Tap **Refill Tank/Bin** to set the current volume to the tank/bin capacity.

Tip – To empty the tank/bin contents, tap **Manual Flush**. This engages the Variable Rate Drive continuously, without moving the implement.

Hardware tab

1. Select the *Hardware* tab:



***Note –** The numbers beneath each switch indicate the number of the sections assigned to that switch. So, switch 1 controls section 1, switch 2 controls section 2, switch 3 controls section 3, and so forth. You cannot change the numbers as they are automatically assigned. If you are not using the 12-section switch box, a "virtual" switch box with six sections is shown.*

***Note –** Modules appear in the order they are installed on the implement, viewed by standing behind the implement and looking in the general direction of travel.*

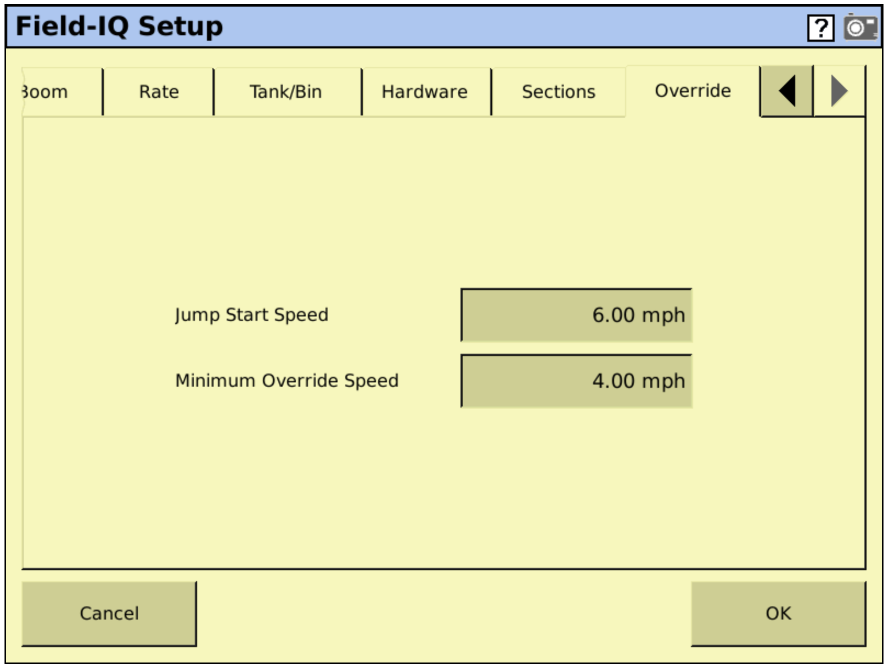
Tip – To change the order of the modules on the *Hardware* tab, tap the icon of the module you want to move and then tap the directional arrows to move the icon.

2. Adjust the width value for each rate control module by tapping the *Width* box. Enter the appropriate value and then tap **OK**.

3. Adjust the sections value for each Rate and Section control module by tapping the *Sections* box. Enter the appropriate value and then tap **OK**.

Override tab

1. Select the *Override* tab:



2. In the *Jump Start Speed* field, enter a value.

   This sets the speed that the Field-IQ master switch box Master switch uses when it is put into the jump start position.

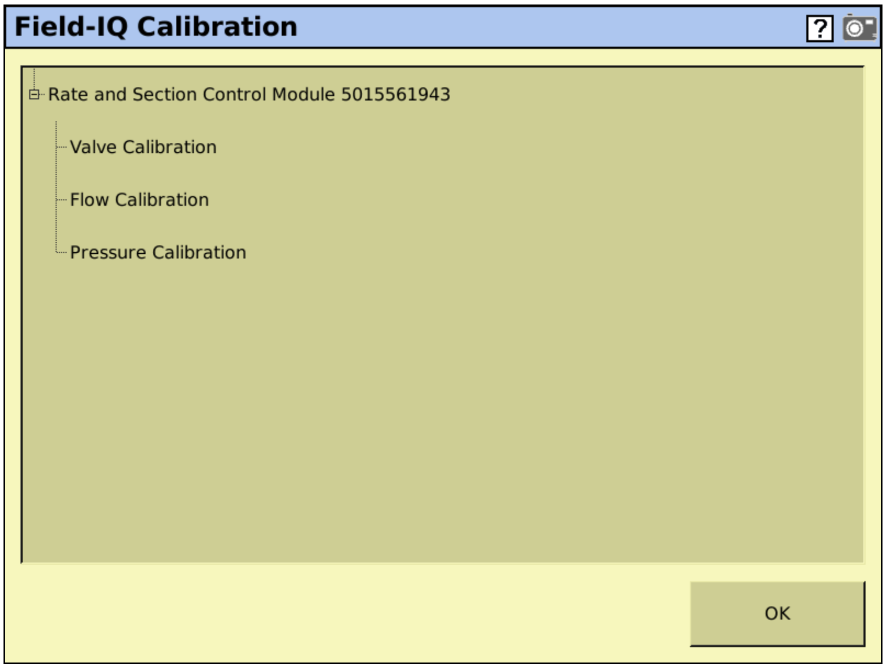
3. In the *Minimum Override Speed* field, enter a value.

   This setting maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds that may reach the physical limitations of the system.

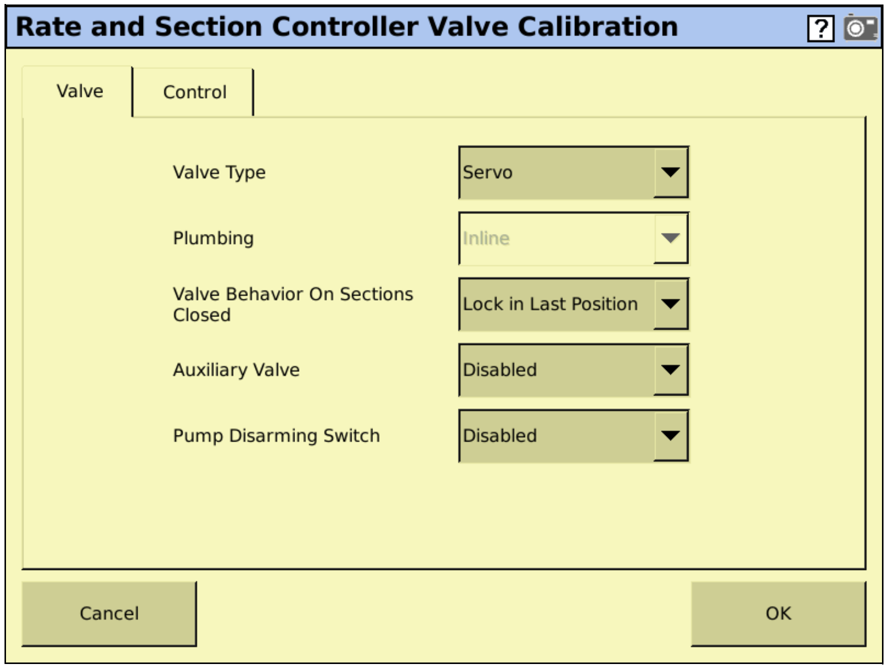
Calibrating the modules

The Field-IQ *Calibration* option only appears on the *Configuration* screen if you have at least one Field-IQ Rate and Section control module installed.

1. From the *Configuration* screen, select the Field-IQ plugin and then tap **Calibrate**.
2. From the *Field-IQ Calibration* screen, select the Rate and Section Control Module to be calibrated. (The message Not calibrated appears at the end of the modules that need calibration.) The following screen appears:



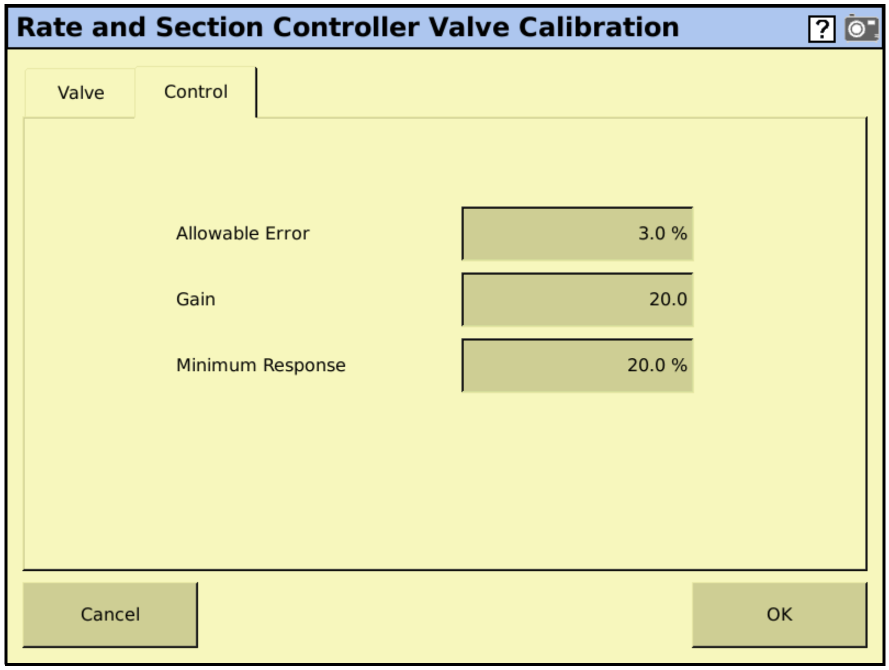
3. Tap *Valve Calibration*. The following screen appears:



4. Select the *Valve* tab and then select the appropriate value for each field:

For this field …	Select one of the following options …
Valve Type	***Pump Servo***: The Pump Servo setting controls an electric motor which actuates a hydraulic valve. As the valve actuates, it adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***PWM***: The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***Fast Servo***: A 4 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example a DICKEY-john servo, Mid-Tech servo, or Raven Fast Valve. ***Servo***: A 2 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example a Raven standard servo. ***Hardi % bypass scenario***: Most commonly used on Hardi sprayers equipped with 3 way section valves that return flow to tank when the boom section is off.
Plumbing	***Inline***: Valve is in the solution line going to the boom. The valve opens to increase application rate. ***Bypass***: Valve is in the Return to Tank line. The valve closes to increase the application rate.
Valve Behavior on Sections Closed	***Close***: When all sections are off, the control valve returns to the closed position. ***Lock in Last Position***: When all sections are off, the control valve remains in the last position. This setting allows the system to return to the target rate faster.
Auxiliary Valve	If you have an Auxiliary Valve installed, select one of the following: ***Master***: Valve closes when the system is turned off. ***Dump***: Valve opens to dump flow to return line when the system is turned off.
Pump Disarming Switch	***Enable***: Select this option if you have a Pump Disarming Switch installed.

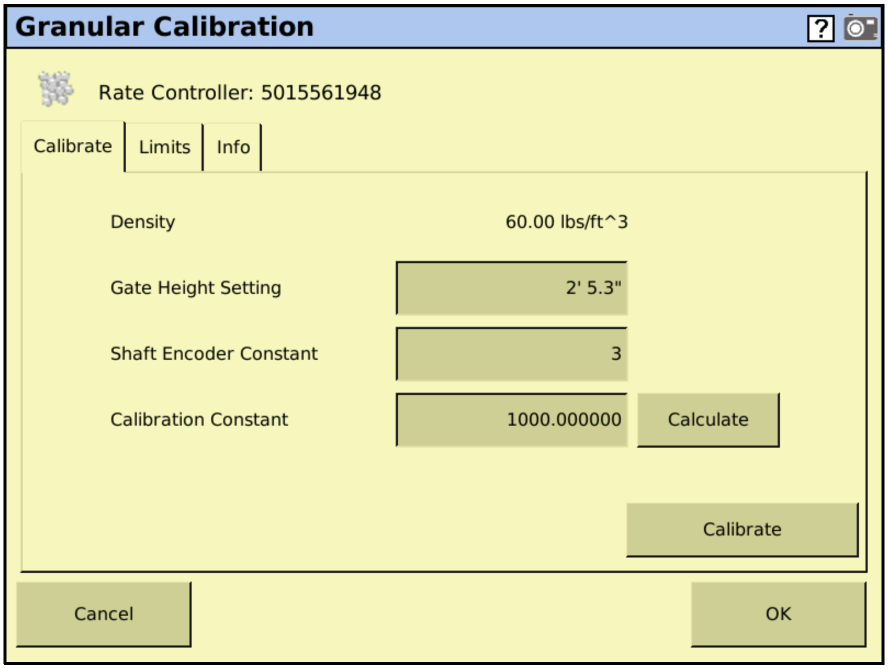
5. Select the Control tab:



6. Enter the following values:
   – *Allowable Error*
   – *Gain*
   – *Minimum Response.*

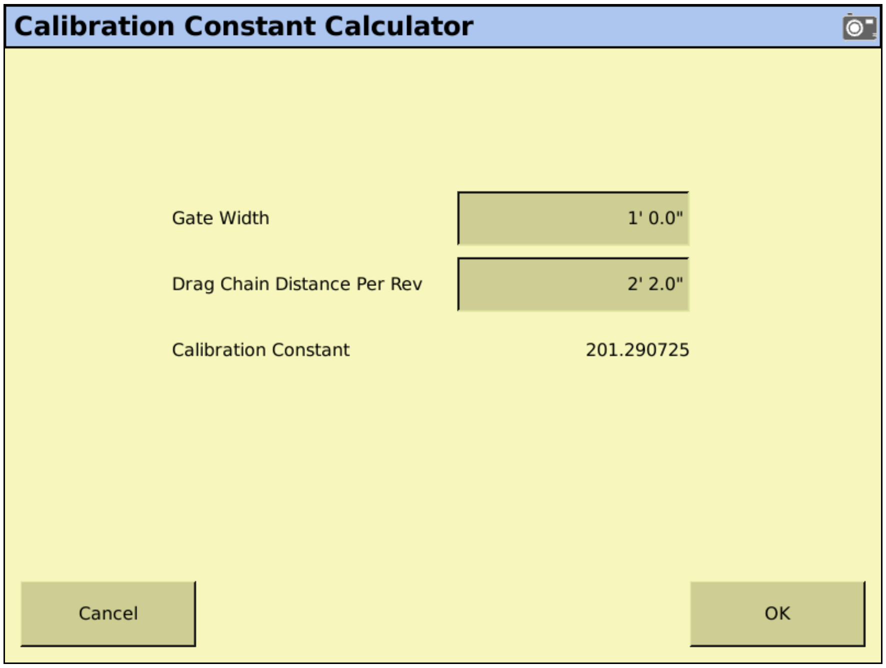
Note *– For information about the appropriate values for your sprayer, see the Support Note - Field-IQ Crop Input Control System: For Sprayers and Spreaders.*

7. Tap **OK** to return to the main calibration screen, and then tap *Flow Calibration*. The following screen appears:



8. Enter the following values:
   - *Gate Height Setting*
   - *Shaft Encoder Constant*

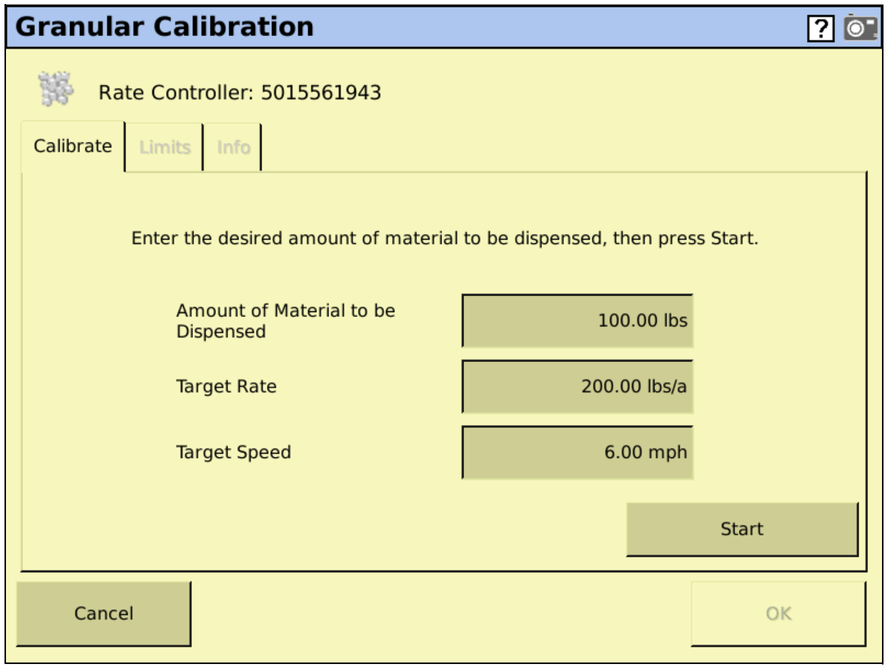
9. To calculate the calibration constant, tap **Calculate.** The following dialog appears.



10. Enter the *Gate Width* and *Drag Chain Distance Per Rev*. The system calculates the Calibration Constant.
11. Tap **OK** to return to the *Granular Calibration* Screen.
12. Place a clean empty container under the spreader to capture the material dispensed during the calibration, and then tap **Calibrate**.

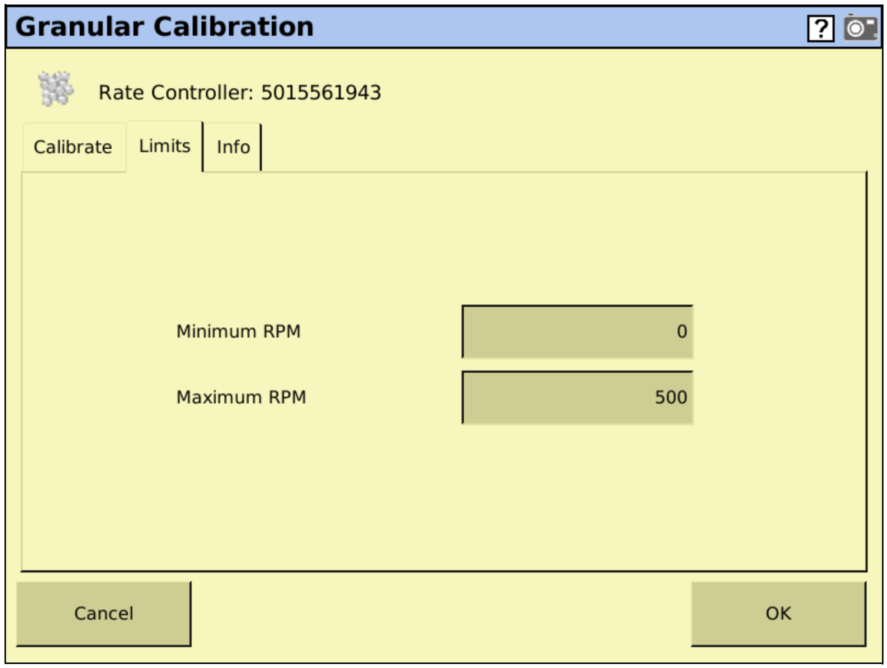
CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

13. The *Granular Calibration* screen appears:

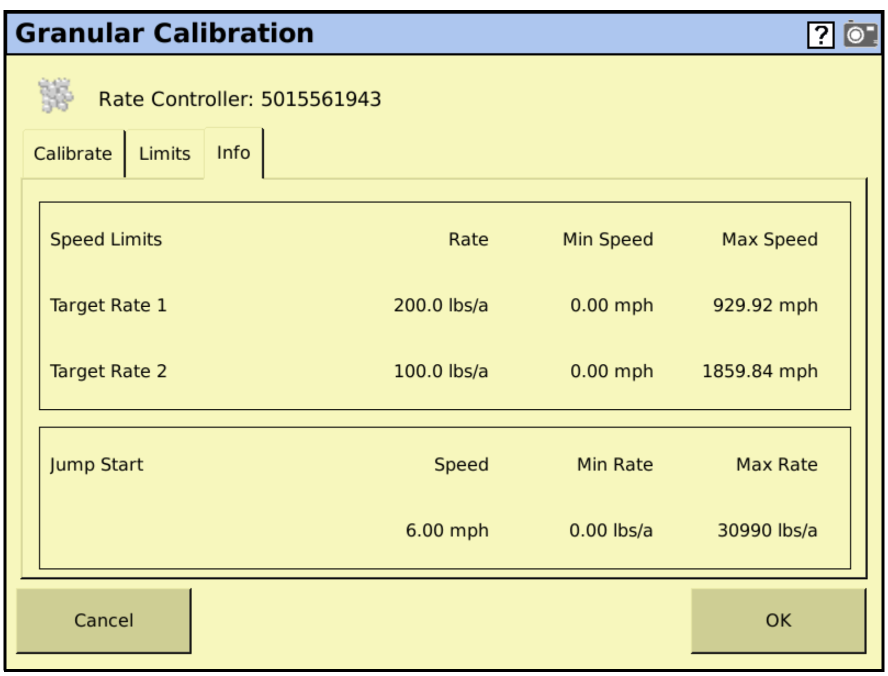


14. Enter the following values:
    - *Amount of Material to be Dispensed:* This is the amount dispensed during the calibration.
    - *Target Rate*
    - *Target Speed*
15. To begin the calibration, tap **Start**, and then follow the on-screen instructions.

16. Select the *Limits* tab:



17. Enter the following values:
    - *Minimum RPM*
    - *Maximum RPM*
18. Select the *Info* tab to view the system's operational limits (based on the RPM limits, target rates, and application width):

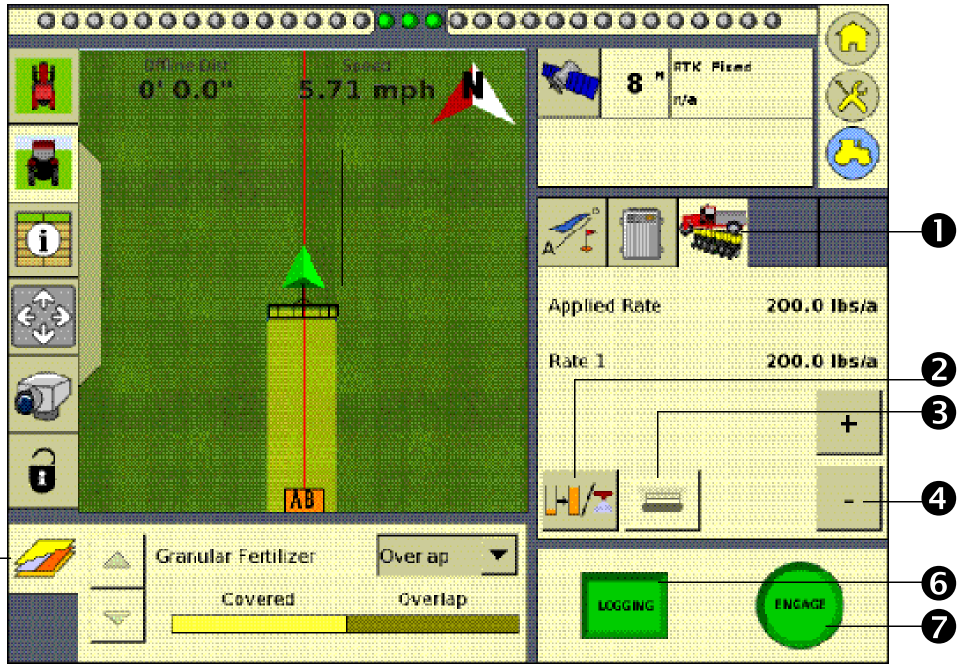


19. Tap **OK**.

Operating in the field

1. From the Home screen, press .
2. From the *Configuration Selection* screen, configure the display/vehicle/implement settings and then tap **OK**.
3. From the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

Spinner Spreading Run screen



	Feature	Description
1	Field-IQ Plugin tab	
2	Tank/Bin button	Shows capacity, warning level, and current volume and access to the Refill Tank/Bin button.
3	Gate Opening button	Sets the current value of the gate opening.
4	Increase/Decrease buttons	Increases and decreases the application rate by the amount specified during setup.
5	Coverage Logging tab	Select the coverage logging attribute to be displayed on the screen.
6	Logging button	Green – Logging enabled. Red – Logging.
7	Engage button	Green – Auto guidance engaged. Gray – Auto guidance can be engaged. Red – Auto guidance cannot be engaged.

Field-IQ Anhydrous

Before starting the Field-IQ plugin setup on the FM-1000 integrated display, Make sure that:

- All components of the system are installed on the vehicle and implement.
- The Field-IQ plugin has been added to the FM-1000 integrated display configuration.

  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Ensure that the Field-IQ icon appears in the list. If the icon does not appear, tap **Add/Remove** to add the plugin to the configuration.
- The Implement Setup has Strip Tillage as the selected operation.

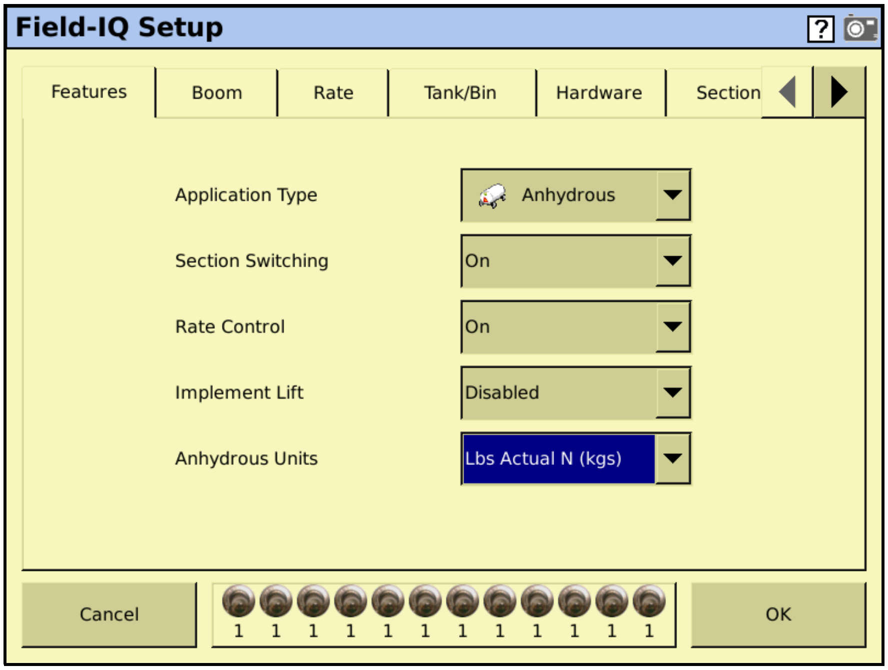
  From the Home screen, tap the Run icon. Next to Implement, tap **Edit**. The *Configuration* screen appears. Select the implement from the list on the left and then tap **Setup**. The *Implement Setup* screen appears. In the *Operations* tab, select Strip Tillage and then tap **OK**.

For more information about setting up the implement, see Chapter 7, Implement Configuration.

Field-IQ setup for Anhydrous

1. From the Home screen, tap the  icon. The *Configuration Selection* screen appears.
2. Next to Implement, tap **Edit**. The *Configuration* screen appears.
3. Select Field-IQ and then tap **Setup**.

Features tab



1. In the *Application Type* drop-down list, ensure that Anhydrous is selected.
2. In the *Boom Switching* drop-down list, select either On or Off.

   When On is selected, Automatic Section Control is active and at least one Field-IQ section control module must be installed.
3. In the *Rate Control* drop-down list, select either On or Off.

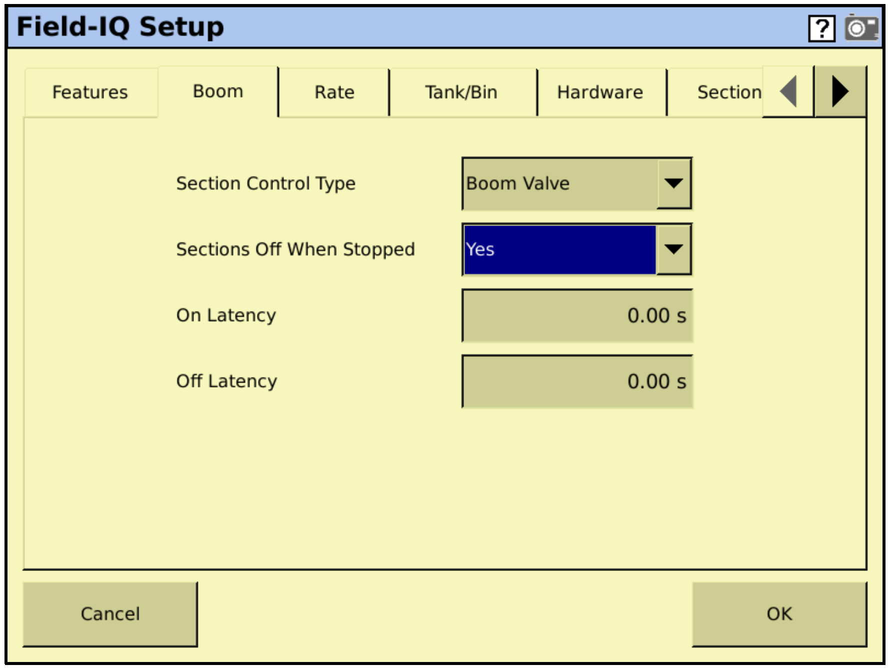
   When On is selected, Rate Control is active and at least one Field-IQ Rate and Section control module must be installed.
4. In the *Implement Lift* drop-down list, select either Enabled or Disabled.

   Select Enabled for the system to use the implement lift to start and stop coverage logging.

   Select Disabled for the system to ignore the implement lift switch (if installed). You can manually control coverage logging from the Run screen.
5. From the *Anhydrous Units* drop-down list, select one of the following:
   - Lbs actual N
   - Lbs NH3

Boom tab

1. Select the *Boom* tab:



2. To control whether the system sends a high or a low signal to close a section valve, select one of the following options from the *Section Signal* drop-down list:

   – Air Clutch

   – Electric Clutch

   – Boom Valve

   – Liqui Block

CAUTION – Selecting the incorrect value causes the system to operate opposite of the required result.

3. In the *Turn Off When Stopped* drop-down list, select an option.

   Selecting Yes turns off sections when the GPS speed is zero.

4. In the *On Latency* field, enter a value.

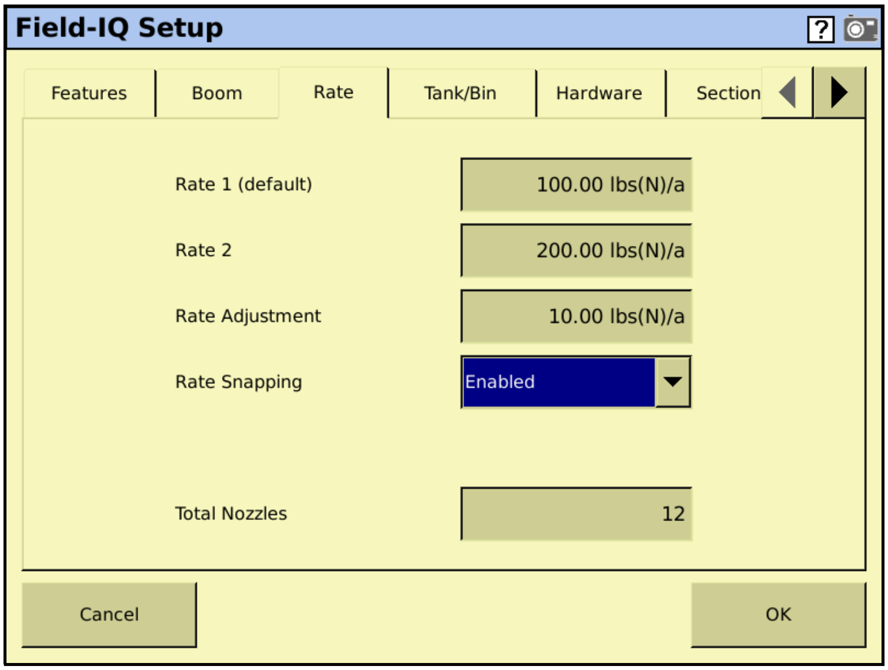
   By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase the On Latency value to compensate the delay, and Field-IQ will turn on before they need to be turned on.

5. In the *Off Latency* field, enter a value.

By default, it is set to 0.0 seconds. Use this unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase to compensate the delay, and Field-IQ will turn off before they need to be turned off.

Rate tab

1. Select the *Rate* tab:



***Note –** The Rate tab is only visible if you have at least one Field-IQ Rate and Section control module installed.*

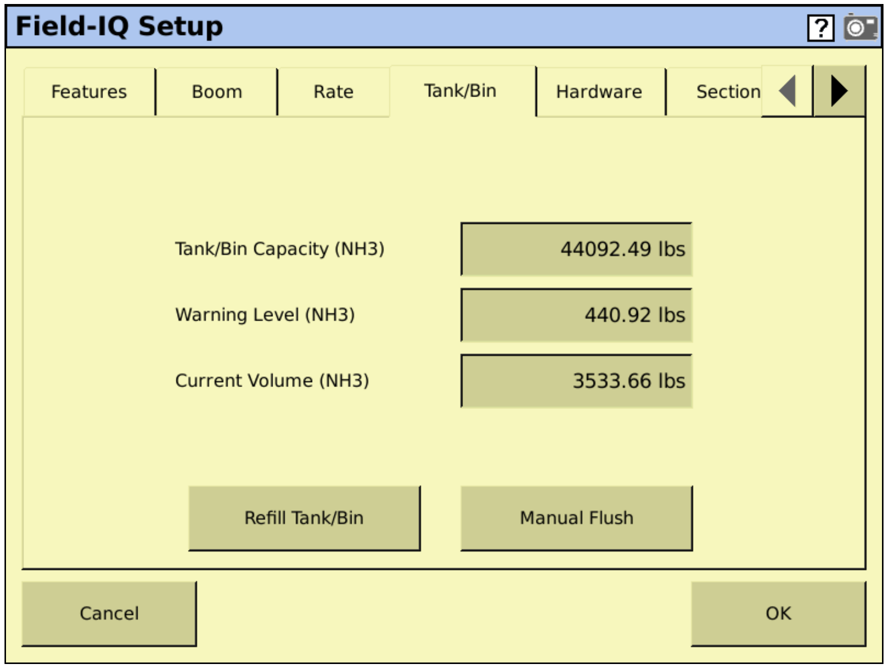
2. In the *Rate 1* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 1.
3. In the *Rate 2* field, enter a value. This is the seeding rate to be used when the Rate Switch in the Field-IQ master switch box is in Rate 2.
4. In the *Rate Increment* field, enter a value. This is the increment to be used each time the Increment/Decrement switch is pressed.
5. In the *Rate Snapping* drop-down list, select an option.

   Select Enabled to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate.

   Select Disabled to show the actual applied value.
6. In the *Total Nozzles* field, enter the total number of knives on the anhydrous bar.

Tank/Bin tab

1. Select the *Tank/Bin* tab:



***Note** – The Tank/Bin tab is only visible if at least one Field-IQ Rate and Section control module is installed.*

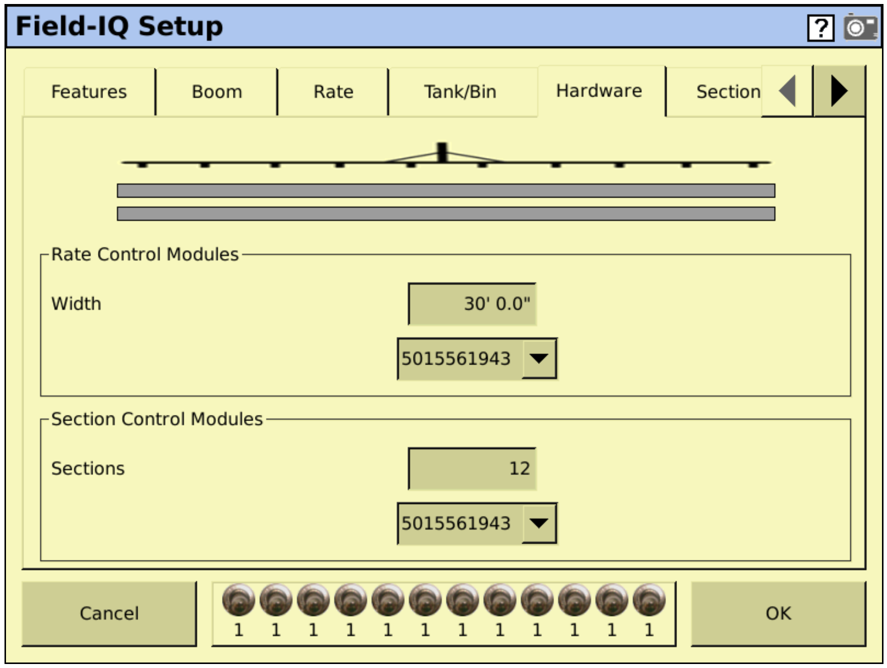
2. In the *Tank/Bin Capacity* field, enter the total capacity of the planter.
3. In the *Warning Level* field, enter the level at which you will receive notification when the capacity level drops below the assigned value.
4. In the *Current Volume* field, enter the current volume of the tank.

Tip – Tap **Refill Tank/Bin** to set the current volume to the tank/bin capacity.

Tip – To empty the tank/bin contents, tap **Manual Flush**. This enables the system to manually apply continuously without moving the implement.

Hardware tab

1. Select the *Hardware* tab:



***Note** – The numbers beneath each switch indicate the number of the sections assigned to that switch. So, switch 1 controls section 1, switch 2 controls section 2, switch 3 controls section 3, and so forth. You cannot change the numbers as they are automatically assigned. If you are not using the 12-section switch box, a "virtual" switch box with six sections is shown.*

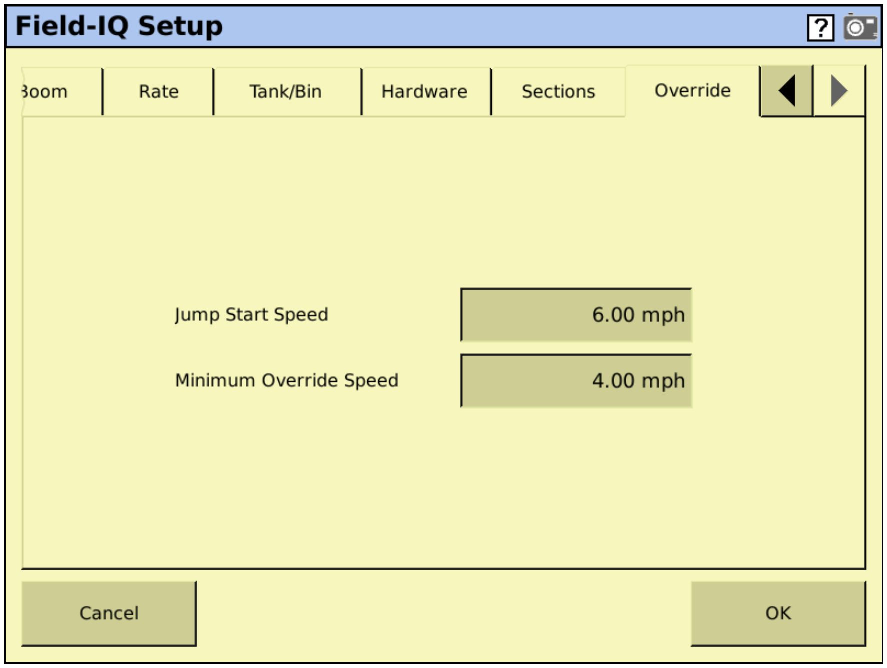
***Note** – Modules appear in the order they are installed on the implement, viewed by standing behind the implement and looking in the general direction of travel.*

Tip – To change the order of the modules on the *Hardware* tab, tap the icon of the module you want to move and then tap the directional arrows to move the icon.

2. Adjust the width value for each rate control module by tapping the *Width* box. Enter the appropriate value and then tap **OK**.
3. Adjust the sections value for each Rate and Section control module by tapping the *Sections* box. Enter the appropriate value and then tap **OK**.

Override tab

1. Select the *Override* tab:



2. In the *Jump Start Speed* field, enter a value.

   This setting controls the control speed to be used when the Field-IQ master switch box Master switch is put in the jump start position.

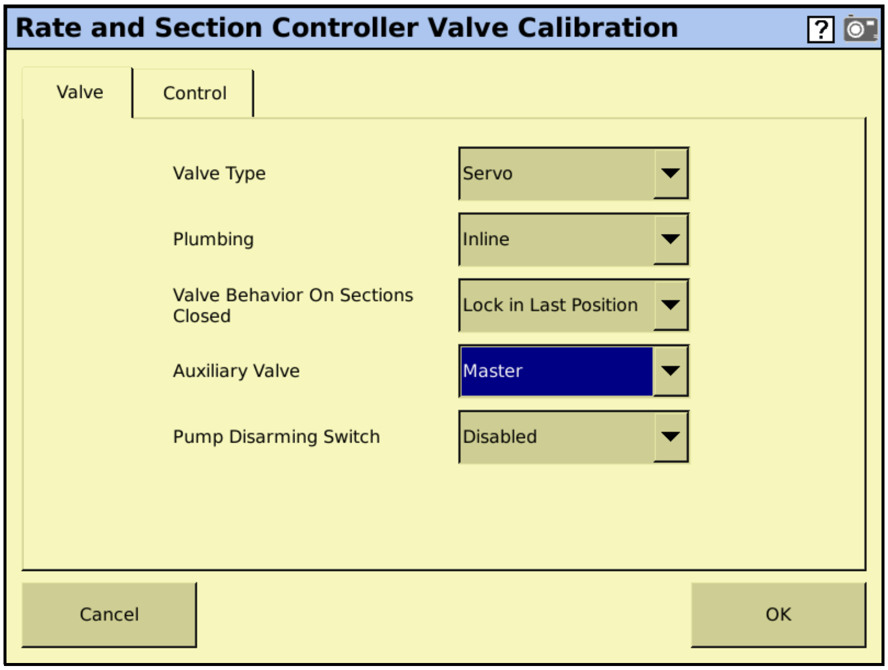
3. In the *Minimum Override Speed* field, enter a value.

   This setting maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds that may reach the physical limitations of the system.

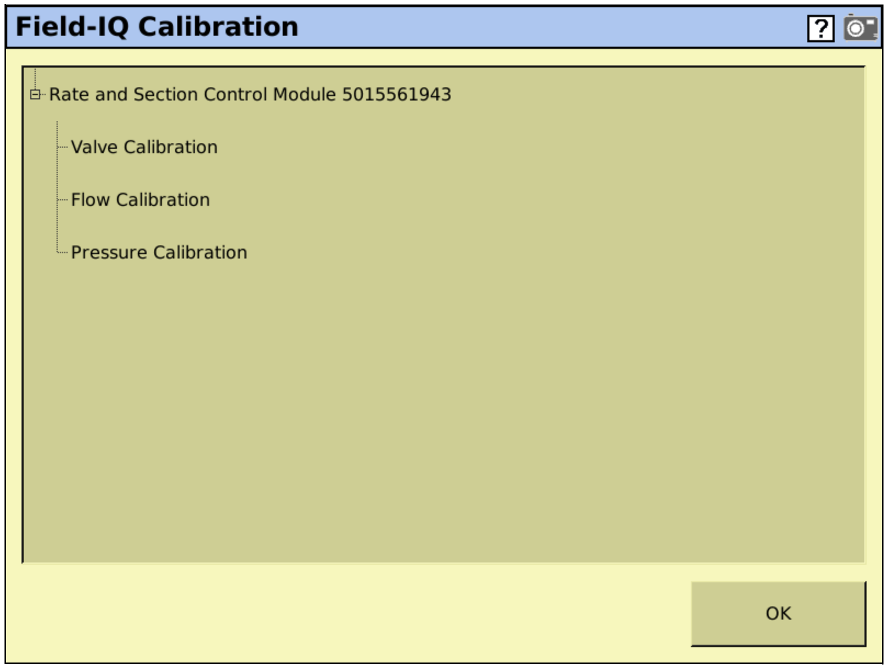
Calibrating the modules

The Field-IQ *Calibrate* option only appears on the *Configuration* screen if you have at least one Field-IQ Rawson control module installed.

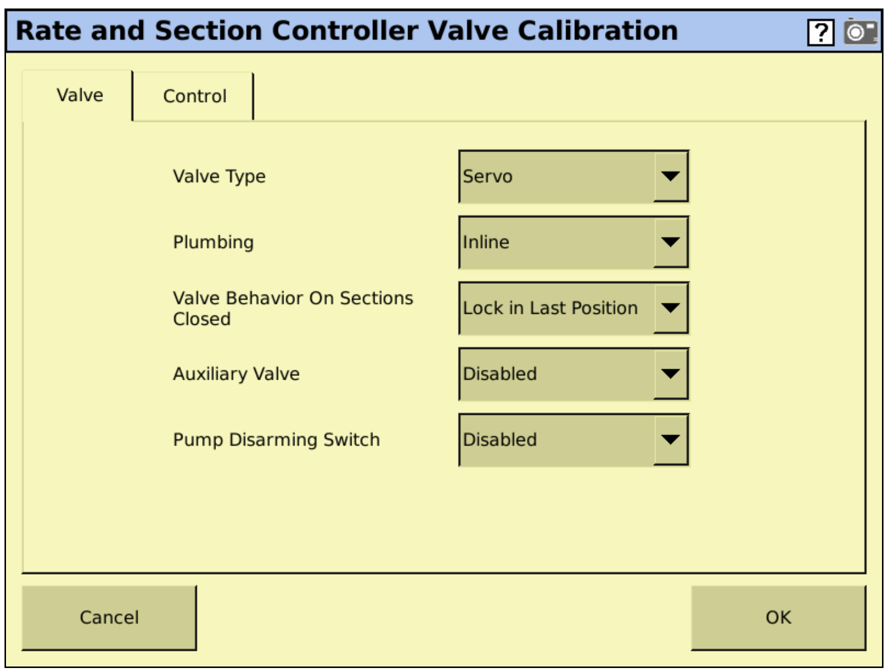
1. From the *Configuration* screen, select the Field-IQ plugin and then tap **Calibrate**.
2. From the *Field-IQ Calibration* screen, select the Rate and Section Control Module to be calibrated. The message Not calibrated appears at the end of the modules that need calibration.
3. Tap *Valve Calibration. The following screen appears*:



4. Select *Valve Calibration*. The following screen appears:



5. Tap *Valve Calibration*. The following screen appears:

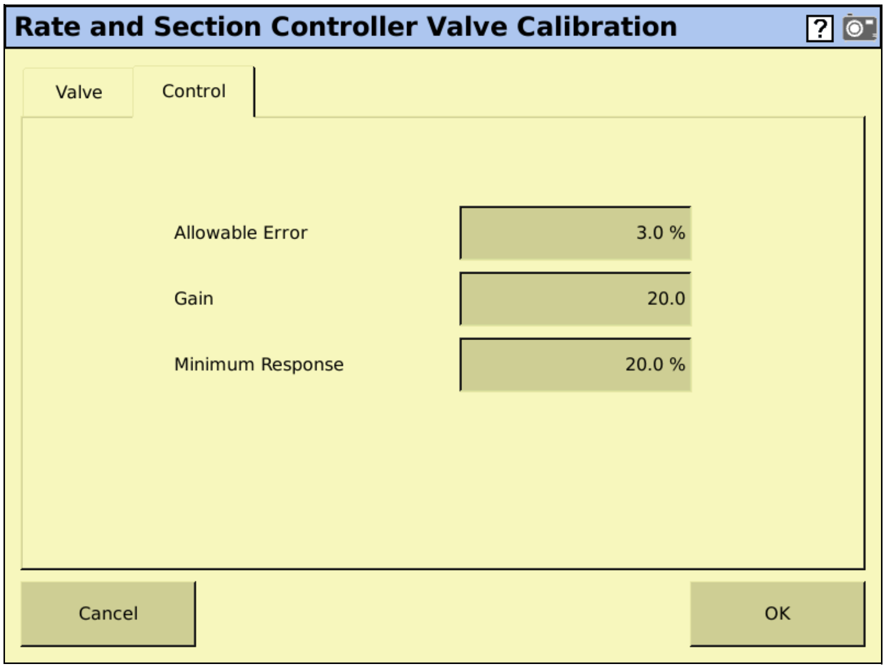


6. Select the *Valve* tab, and then select the appropriate value for each field:

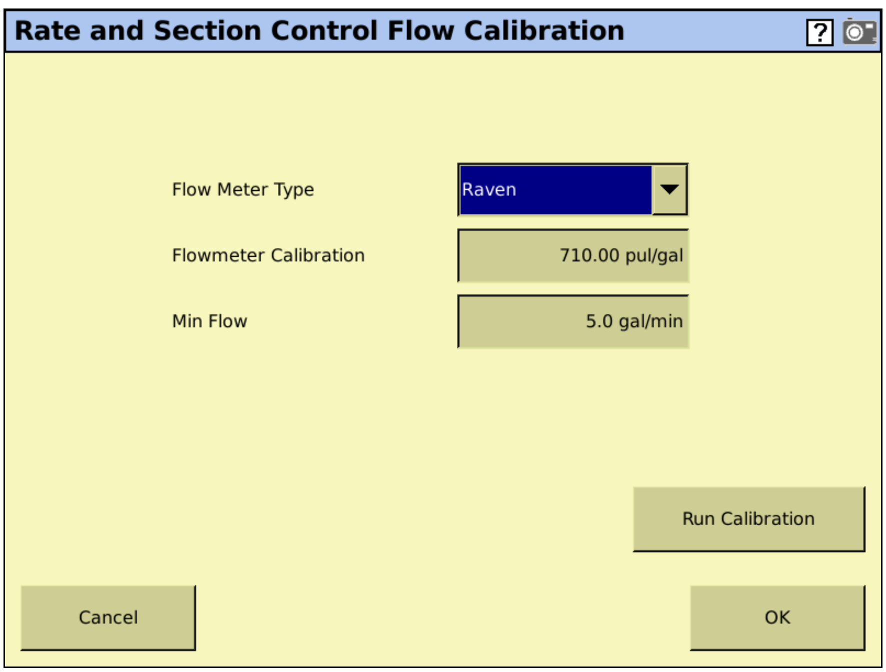
For this field ...	Select one of the following options ...
Valve Type	***Pump Servo***: The Pump Servo setting controls an electric motor which actuates a hydraulic valve. As the valve actuates, it adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***PWM***: The PWM pump setting controls an electric solenoid valve which adjusts the hydraulic flow to the pump. This valve adjusts the application rate indirectly. ***Fast Servo***: 4 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a DICKEY-john servo, Mid-Tech servo, or Raven Fast Valve ***Servo***: 2 wire electric motor turns a ball or butterfly valve to increase or decrease flow, for example, a Raven standard servo. ***Hardi % bypass scenario***: Most commonly used on Hardi sprayers equipped with 3 way section valves that return flow to tank when the boom section is off.
Plumbing	***Inline***: Valve is in the solution line going to the boom. The valve opens to increase application rate. ***Bypass***: Valve is in the Return to Tank line. The valve closes to increase the application rate.
Valve Behavior on Sections Closed	***Close***: When all sections are off, the control valve returns to the closed position. ***Lock in Last Position***: When all sections are off, the control valve remains in the last position. This setting allows the system to return to the target rate faster.
Auxiliary Valve	If you have an Auxiliary Valve installed, select one of the following: ***Master***: Valve closes when the system is turned off. ***Dump***: Valve opens to dump flow to return line when the system is turned off.
Pump Disarming Switch	***Enable***: Select this option if you have a Pump Disarming Switch installed.

7. Select the *Control* tab. Enter a value for each of the following:
   - Allowable Error
   - Gain
   - Minimum Response

***Note** – For information about the appropriate values, see the Getting Started Guide.*

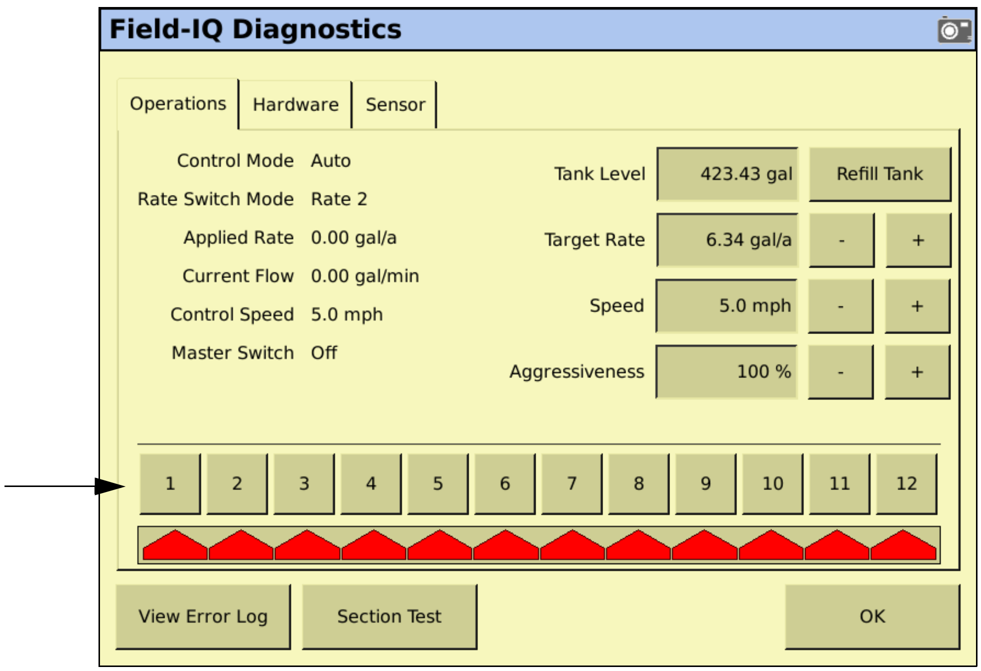


8. Tap **OK** to return to the main calibration screen, and then tap *Flow Calibration*. The following screen appears:



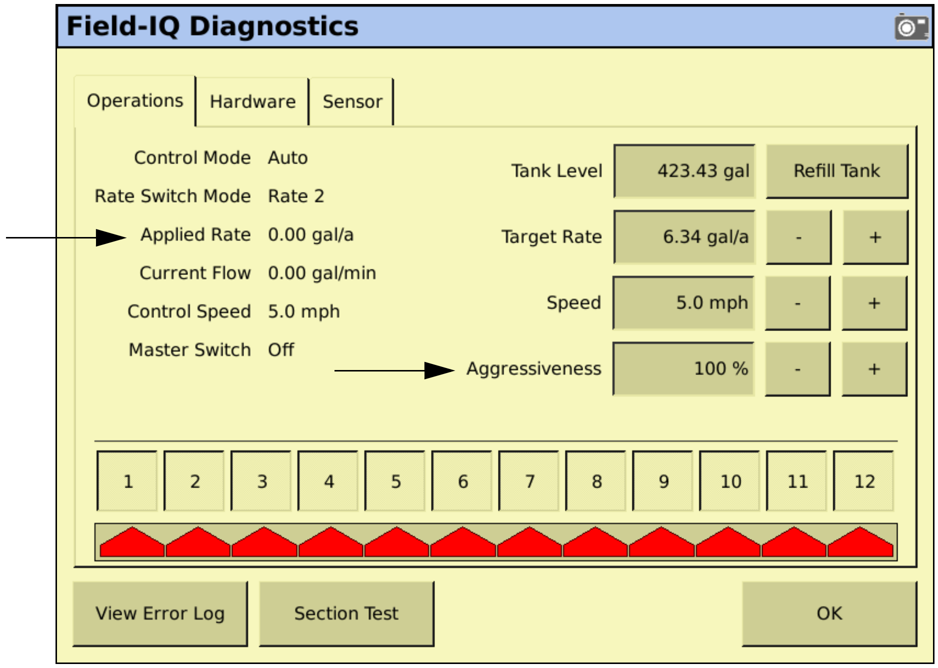
CAUTION – Moving parts during this operation. Ensure the implement is safe to operate.

9. Tap **OK**. Enter a value for each of the following:
   - *Flow Meter Type*: select an option from the drop-down list.
   - *Flowmeter Calibration*: enter the number from the flow meter tag
   - *MinFlow*: enter the required minimum flow rate for the system. Use this setting to keep the control valve and flow meter above the minimum operating level.
10. Tap **Run Calibration**, and then follow the on-screen instructions.
11. If used, select the connector that the pressure sensor is connected to, and then enable the sensor.
12. Tap **Run Calibration**, and then follow the on-screen instructions.
13. Tap **OK** to return to the *Configuration* screen.
14. Select the *Field-IQ plugin* tab and then tap *Diagnostics.* The following screen appears:



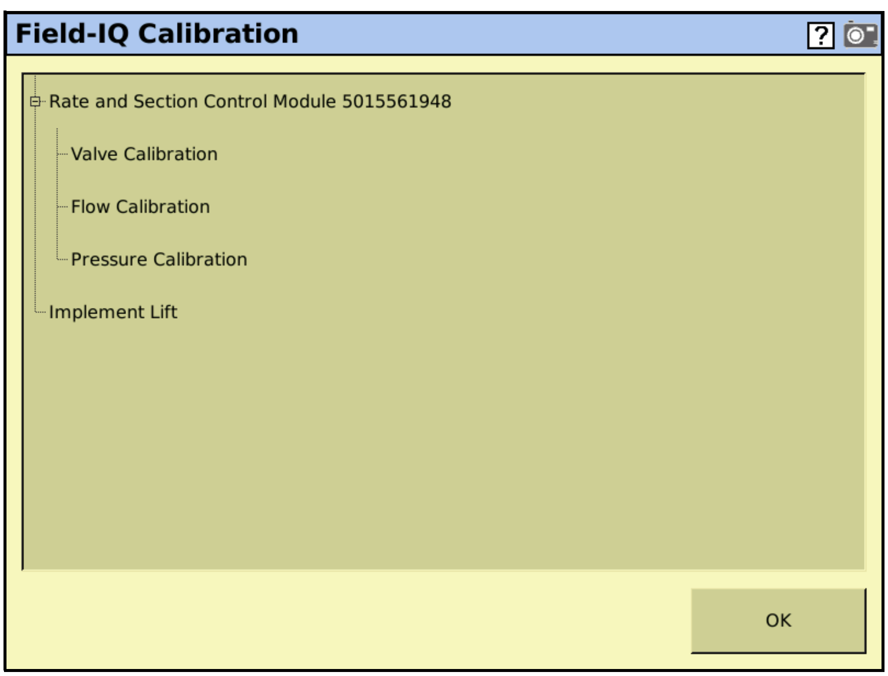
15. To enable the sections, tap the numbered section tabs above each of the section icons.
16. Enter a value for each of the following:
   - *Target Rate*: The required rate for the rate switch
   - *Speed*

17. Operate the sprayer, and check value shown for the *Applied Rate*. If necessary, adjust the *Aggressiveness* setting to achieve the desired rate.



Calibrating the implement lift switch

1. From the *Field-IQ Calibration* screen, select the Implement Lift option:



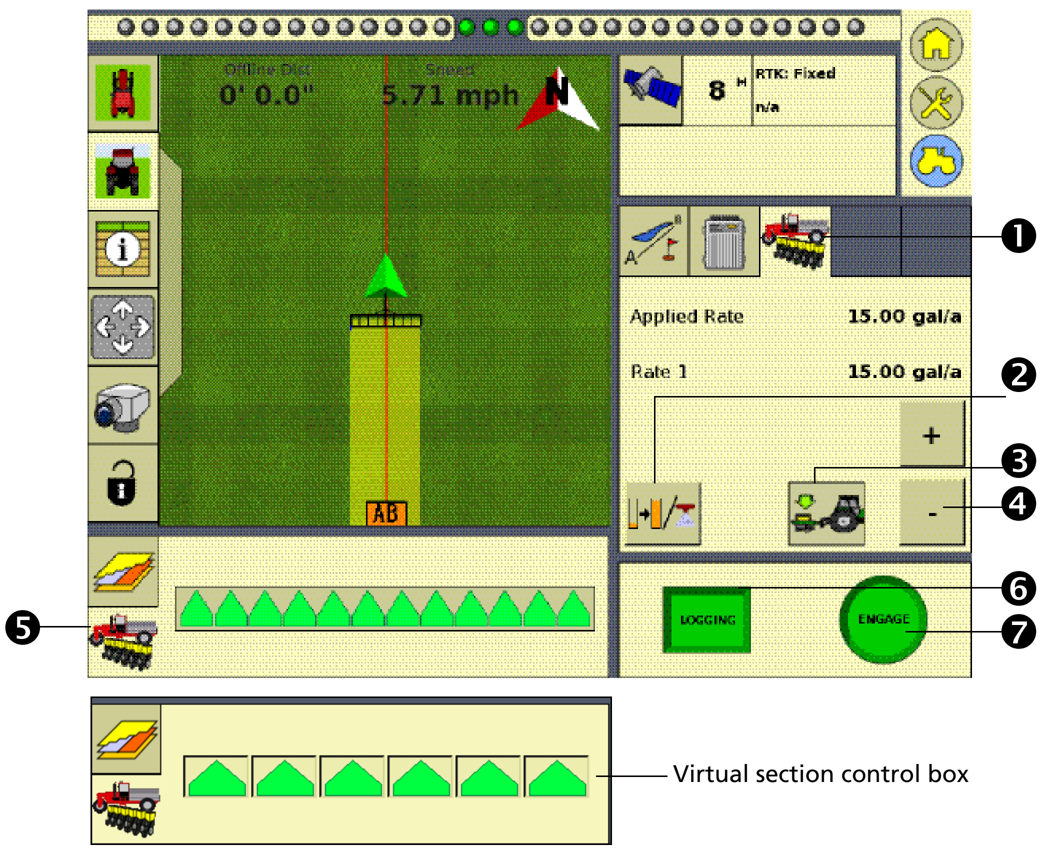
2. Tap **OK**.

3. Raise the implement and then tap **Next**.
4. Lower the implement and then tap **Next**.
5. Tap **OK** to return to the Field-IQ *Calibration* screen.

Operating in the field

1. From the Home screen, press .
2. From the *Current Configurations* screen, configure the display/vehicle/implement settings and then tap **OK**.
3. From the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

Liquid Strip Tillage Run screen

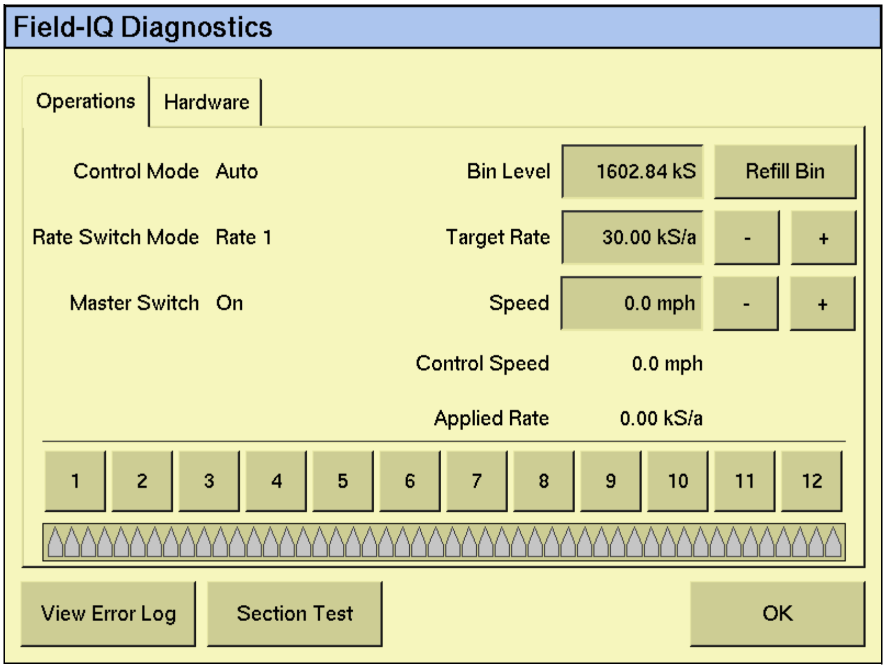


	Feature	Description
❶	Field-IQ Plugin tab	
❷	Tank/Bin button	Shows capacity, warning level, and current volume and access to the Refill Tank/Bin button.

	Feature	Description
❸	Implement Switch Status	Green arrow down – Indicates the implement is lowered. Red arrow up – Indicates the implement is raised.
❹	Increase/Decrease buttons	Increases and decreases the application rate by the amount specified during setup.
❺	Field-IQ Status tab	Shows the engage status of each row on the implement. Green – Engaged. Gray – Section closed due to overlap. Red – Not engaged or section manually turned off.
❻	Logging button	Green – Logging enabled. Red – Logging.
❼	Engage button	Green – Auto guidance engaged. Gray – Auto guidance can be engaged. Red – Auto guidance cannot be engaged.

Using the Diagnostics Tab

From the *Configuration* screen, select the Field-IQ plugin and then tap **Diagnostics**:



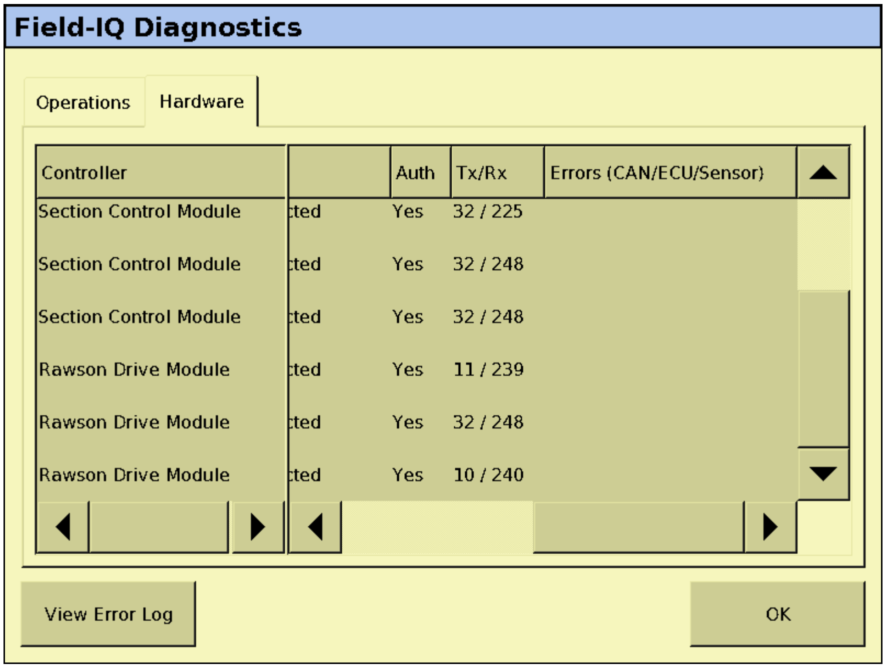
The *Operations* tab displays the current status of:

- Control Mode (Auto or Manual)
- Rate Switch Mode (Manual, Rate 1, or Rate 2)
- Master Switch (Off, On, or Jump Start)

This screen also enables you to manually adjust:

- Bin Level – Enter a new value or select Refill Tank.
- Target Rate – Decrease or increase.
- Speed – Decrease or increase.
- Switches – If you are using the optional Field-IQ individual section switch box, this screen indicates which switches have been assigned to each section. To test this, flip each switch in the section switch box. The section it is assigned to appears gray.
- **View Error Log** – Shows all the errors that have occurred since the error log was cleared.
- **Section Test** – The system begins a sequence of engaging each section and groups of sections.

The *Hardware* tab displays the connected Field-IQ CAN modules and the following attributes:



- Serial number
- Position on the implement
- Firmware version
- Status of CAN connection
- Tx/Rx number of packets
- Errors associated with the module

CHAPTER

11

The Tru Application Control Plugin

In this chapter:

Introduction

When the Tru Application Control plugin is installed, the FM-1000 integrated display can control application devices, such as a planter, sprayer, drill, air seeder, spreader, or anhydrous ammonia applicator. This chapter explains how to configure and use the Tru Application Control plugin.

Configuration and operation differs depending on which implement type you are using. This chapter is in five sections—see the relevant section for your implement.

CAUTION – In this chapter, the value "0" represents "disabled". For example, the *Shut Off Speed* option enables you to set the low speed that shuts off the system. If you set the *Shut Off Speed* to 0, it ***disables*** that option. Therefore, when the speed reaches 0, the implement ***does not*** shut off.

Note – *You can only install one variable rate control plugin at once. You cannot run the EZ-Boom plugin or the Serial Rate Control plugin when the Tru Application Control plugin is installed.*

Note – *To unlock the FM-1000 integrated display to use the Tru Application Control plugin, see* *Entering the password to activate a plugin, page 195*.

Introduction to flow and application functionality

This chapter describes how to use the Tru Application Control plugin with DICKEY-john components to control the following applications:

Item	Description
Planter	• Seed monitoring for up to 70 rows for population or 80 rows for blockage • Seed population, liquid, and granular control of up to 4 products • Accessory monitoring of additional optional sensors (hopper, pressure, and RPM) • Variety tracking • Variable Rate Technology (VRA) for up to 4 products at once • Tru Count Air Clutch support for turning rows or sections on or off automatically
Drill	• Seed monitoring for up to 148 rows for population or blockage • Seed population, liquid, and granular control of up to 4 products • Accessory monitoring of additional optional sensors (hopper, pressure, and RPM) • Variety tracking • Variable Rate Technology (VRA) for up to 4 products at once
Air Seeder	• Seed monitoring for up to 148 rows for population or blockage • Seed population, liquid, and granular control of up to 4 products • Accessory monitoring of additional optional sensors (hopper, pressure, and RPM) • Variety tracking • Variable Rate Technology (VRA) for up to 4 products at once • Anhydrous ammonia control of up to 2 products • Variable Rate Technology (VRA) for up to 2 products at once

Item	Description
Sprayer	• Liquid control of up to 4 products • Accessory monitoring of additional optional sensors (pressure or RPM) • Variable Rate Technology (VRA) for up to 4 products at once • Automatic boom section control for turning sections on or off automatically
Spreader	• Granular control of up to 4 products • Accessory monitoring of additional optional sensors (hopper or RPM) • Variable Rate Technology (VRA) for up to 4 products at once

Definition of terms

Planter and drill

Traditionally, a ***planter*** is used for planting corn, soybeans, or other crops that require a specific row spacing.

Traditionally, a ***drill*** is used for sowing wheat, barley, grass, or other crops that do not require row spacing.

When controlled with the Tru Application Control plugin, the planter or drill can support up to four channels of material at once, enabling you to plant combinations of seed or to plant the seeds with liquid or granular fertilizer.

Air seeder

An ***air seeder*** also plant seeds, but it uses pressurized air to push seeds from an external seed cart to the planter.

When controlled with the Tru Application Control plugin, the air seeder can support up to four channels of material at once, enabling you to plant combinations of seed or to plant the seeds with liquid, granular fertilizer, or anhydrous ammonia.

The ***anhydrous unit*** is used to inject anhydrous ammonia (NH3) into the soil.

Anhydrous ammonia is stored as a liquid in a cooler tank towed behind the vehicle, but because it has a boiling point of -34°C (-29°F), it becomes a gas as soon as it is released. It is injected into the ground as a gas, where it enriches the soil with nitrogen.

With the Tru Application Control plugin, an anhydrous unit can control up to two channels of product at once.

Sprayer

You can use a ***sprayer*** for liquids, such as liquid fertilizer and pesticides.

When controlled with the Tru Application Control plugin, the sprayer can control up to four products at once.

Spreader

A ***spreader*** spreads granular product over the ground.

With the Tru Application Control plugin, a spreader can control up to four channels of product at once.

Channel

A ***channel*** is a product that is controlled by a valve with feedback (for example, an application rate sensor or flow meter). You can use a seed, granular seed, granular fertilizer, liquid, or anhydrous product type, which have different set-up parameters.

Section

A ***section*** is any number of spray nozzles or rows that are controlled by either a boom section valve or by Tru Count clutches.

A section can be either a single row/nozzle or multiple rows/nozzles depending on how the system is set up.

Note *– The FM-1000 integrated display allows for up to 24 sections.*

Row

A ***row*** is the individual row unit that seed comes from on the planter. This can be a single section, or can belong to a section that also controls other rows.

Units of measure

The units of measure differ depending on the type of material:

Type	Unit	Symbol	Description
Seed	Metric	kS/ha	Thousands of seeds per hectare
	US/Imperial	kS/a	Thousands of seeds per acre
Granular seed	Metric	kg/ha	Kilograms of seed per hectare
	US/Imperial	lbs/a	Pounds of seed per acre
Liquid application	Metric	L/ha	Liters per hectare
	US/Imperial	Gal/a	Gallons per acre
Granular fertilizer	Metric	kg/ha	Kilograms of fertilizer per hectare
	US/Imperial	lbs/a	Pounds of fertilizer per acre
Anhydrous	Metric	kg/ha	Kilograms of nitrogen per hectare
	US/Imperial	lbs/a	Pounds of nitrogen per acre

Benefits of the system

Product control

To control the product that is output, the system uses valves and feedback sensors. This gives you precise control over product application at varying speeds.

The values read by the feedback sensors are shown on the display.

Independent row or section switching

Planting, seeding, and application equipment has traditionally been limited to fully-on or fully-off operation. However, with the following additional components, you can now control individual rows and sections for precise product application:

- the FM-1000 integrated display Tru Application Control plugin
- one or more Tru Count Air Clutches or boom section valves
- a CSM (Clutch Switch Module) or a BSM (Boom Switching Module)

This gives you two additional options:

- manual section or row control through the switches on the CSM or BSM
- automatic boom and/or row switching

So, when you reach the edge of the field or a waterway, the system automatically turns off the rows or sections that would cover already planted or sprayed ground, and switches them on again when you return to an area that is not yet planted or sprayed.

Controlling row/section switching with a CSM or BSM

The CSM or BSM is a control module with a master switch and six row/section control switches:

The switches enable you to perform manual section control, or the FM-1000 integrated display can use the module to automatically switch sections or rows on and off.

The LEDs show section status, not switch position status. If a section turns off automatically, the light goes off even if the switch is still on.

Note – *The CSM and BSM are used for NH3 section control and planting and spraying applications.*

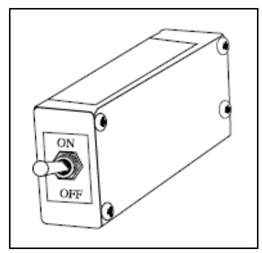
You can join up to 3 generic switch modules to the control module to provide up to 24 switches. The generic switch modules look similar to the control module but do not have a master switch.

You can control one row with each switch, or you can configure more than one row to each switch to control multiple rows at once.

Installation (all implements)

Installing key Tru Application Control components

Installing an implement master switch



When you install a product control system, a master switch is connected to the display.

Note – *When a master switch is installed, you cannot use the display to manually engage application.*

To install the switch:

1. Select a location in the cab that is within easy reach of the operator's seat.
2. Attach the switch with one of the following:
   - Tie wraps
   - Tape
   - Velcro stripping
   - Bond clamps
3. Plug the switch into the FM-1000 integrated display Application Control cab harness.

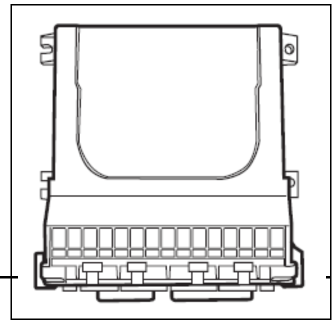
Installing a test switch

You can install a test switch on the implement to set the number of revolutions so that you can review the seed count that the system calculates over a set number of cycles.

Connect the test switch to the 4 Channel Control harness.

CAUTION – Once you finish testing, remove the test switch. If it accidentally engages, the implement could cause injury.

Installing the working set master module

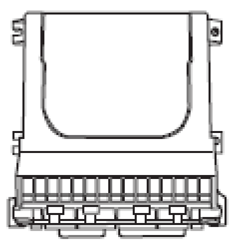
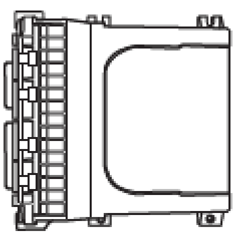
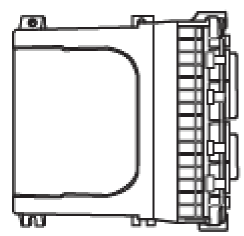


To mount the working set master module (WSMT) on the implement:

1. Select an area on the implement to mount the WSMT that allows for easy hookup and access.
2. Use the module enclosure as a template to mark the location of the mounting holes.

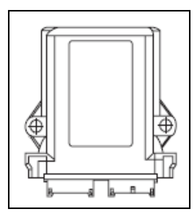
CAUTION – Do not use the master module enclosure as a guide when drilling. Do not overtighten the nuts as this may damage the mounting tabs of the enclosure.

3. Drill four 9/32 inch diameter holes where marked.
4. Select one of the following orientations to mount the WSMT on the vehicle:

Facing down (preferred)	Facing left (acceptable)	Facing right (acceptable)
		

***Note** – Do not install the module in any other orientation. The connection wires must not point upward, or dust and rain may enter the module.*

Installing working set member (WSMB) modules



To mount the working set member modules) (WSMB) on the implement:

1. Select an area on the implement to mount the module.

If you must install the module in a remote or hard-to-reach area on the implement, you can use an extension.

The acceptable mounting orientations are the same as those for a master module. See Installing the working set master module, page 341. Mount the module with the label facing out.

2. Do one of the following:

- To bolt the module to the implement:

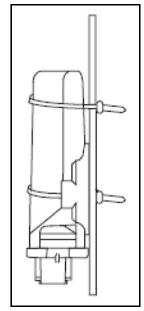
   a. Use the module as a template to mark the position of the 2 bolt holes.

CAUTION – Do not use the member module enclosure as a guide when drilling. Do not overtighten the nuts as this may damage the mounting tabs of the enclosure.

   b. Remove the module and then drill the two 9/32 inch holes that you marked on the frame.

   c. Attach the module to the frame with two ¼ x 20 bolts or a threaded U-bolt.

- To tie-strap the module to the implement:



   a. If mounting holes on the implement are required, use the module as a template to mark the position of the 2 bolt holes.

   b. Drill the two 9/32 inch holes that you marked on the frame.

   c. Feed a long tie-strap through the two mounting holes on the module and then through the holes on the implement.

   d. Securely tighten the tie-strap.

   e. Install a second tie-strap around the module at the label end of the enclosure for additional support.

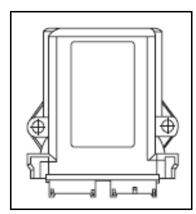
3. Connect a WSMB harness to the module. Insert both connectors until the connector locking tabs engage.

The WSMB module harness can accept a standard DICKEY-john style planter harness. Harnesses are available for a number of row configurations.

4. Repeat these steps for any additional member modules.

***Note** – For correct system operation, you must install a CAN terminator on the last module harness.*

Installing output modules



To mount the output modules on the implement:

1. Select an area on the implement to mount the module.

If you must install the module in a remote or hard-to-reach area on the implement, you can use an extension.

The acceptable mounting orientations are the same as those for a master module. See Installing the working set master module, page 341. Mount the module with the label facing out.

2. Do one of the following:

- To bolt the module to the implement:

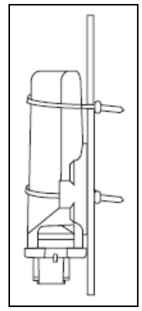
  a. Use the module as a template to mark the position of the 2 bolt holes.

CAUTION – Do not use the output module enclosure as a guide when drilling. Do not overtighten the nuts as this may damage the mounting tabs of the enclosure.

  b. Remove the module and then drill the two 9/32 inch holes that you marked on the frame.

  c. Attach the module to the frame with two ¼ x 20 bolts or a threaded U-bolt.

- To tie-strap the module to the implement:



  a. If mounting holes on the implement are required, use the module as a template to mark the position of the 2 bolt holes.

  b. Drill the two 9/32 inch holes that you marked on the frame.

  c. Feed a long tie-strap through the two mounting holes on the module and then through the holes on the implement.

  d. Securely tighten the tie-strap.

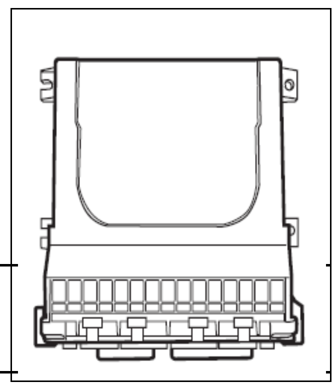
  e. Install a second tie-strap around the module at the label end of the enclosure for additional support.

3. Connect a Tru Count or Boom Section harness to the module. Insert both connectors until the connector locking tabs engage.

4. Repeat these steps for any additional output modules.

Installing the tractor ECU

To mount the tractor ECU in the cab:



1. Select an area in the cab to mount the tractor ECU that allows for easy hookup and access.

2. Use the ECU enclosure as a template to mark the location of the mounting holes.

CAUTION – Do not use the ECU enclosure as a guide when drilling. Do not overtighten nuts as this may damage the mounting tabs of the enclosure.

3. Drill four 9/32 inch diameter holes where marked.

Installing a master module harness

1. Connect the module to the Working Set Master Module harness.
2. If necessary, connect the WSMT valve/sensor harness.
3. Connect any additional adaptor harnesses to the module harness. The WSMT module harness can accept the following adaptor harnesses:
   – **4 Channel Control Harness (Actuator Harness):** This harness allows for 4 output control channels and associated feedback sensors, a hopper level sensor input, a shaft sensor input, a ground speed input, an implement switch input, and an air pressure input. In addition, a pair of 6-pin connectors are available for Servo connection. Install sensors, valves, and so on according to the instructions included with the items. Install the PWM valve assembly and feedback sensor for each control loop and connect the devices to their respective inputs on the harness, making certain to match PWM 1 with FEEDBACK 1, PWM 2 with FEEDBACK 2, and so on. Secure any unused and excess cable lengths where necessary.

   – **Seed Sensor Harness:** This harness accommodates any standard DICKEY-john Seed Sensor harness (PM or SE style). A wide variety of harnesses are available to accommodate various numbers of sensor inputs. Install all seed sensors per the instructions included with the individual sensors. Secure any unused or excess cable lengths as necessary.

   – **Accessory Harness for Air Seeders**: This harness enables you to connect 4 additional air pressure sensors, 4 hopper level sensors, and 1 fan/shaft RPM sensor.

   – **Accessory Harness for Sprayers**: This harness enables you to connect 4 liquid pressure sensors and 2 fan/shaft RPM sensors.

   – **Accessory Harness for Spreaders**: This harness enables you to connect 2 additional hopper level sensors and 2 fan/shaft RPM sensors.

Installing sensors

The FM-1000 integrated display can read the following optional DICKEY-john sensors:

Item	Description
Seed sensor	Provides seed population or blockage information to the system.
Application rate sensor	Measures shaft rotation speed by counting pulses over time. This enables accurate feedback for product control.
Hopper level sensor	Is installed low in the ***hopper*** (planter seed bin) and reports when the seed level drops to that point.
Shaft speed (RPM) sensor	Measures the RPM of the implement driveshaft, either by counting the teeth on a gear, magnets on a shaft, or lug nuts on a wheel.
Air pressure sensor	Is installed in the hopper and provides real-time air pressure or vacuum readings to the system.
Ground speed sensor	Produces pulses that are multiplied by a constant to calculate the speed of the vehicle.

Item	Description
Pulse Width Modulation (PWM) control valves	Provide flow control for seed, liquid, and grain.
Servo control valves	
Flow meters	Ensures accurate feedback to the liquid control channel for optimal control accuracy.
Tru Count Air Clutch® control	Automatically controls planter rows on/off for precise seed placement.
Implement lift switch	Enables on/off control based on the implement position.

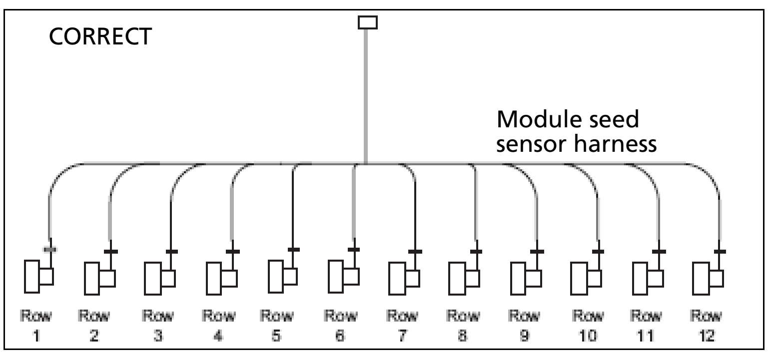
For correct system operation, connect all sensors used with the system as described in the following sections. The system will not identify sensors that are incorrectly installed, resulting in incorrect sensor numbering.

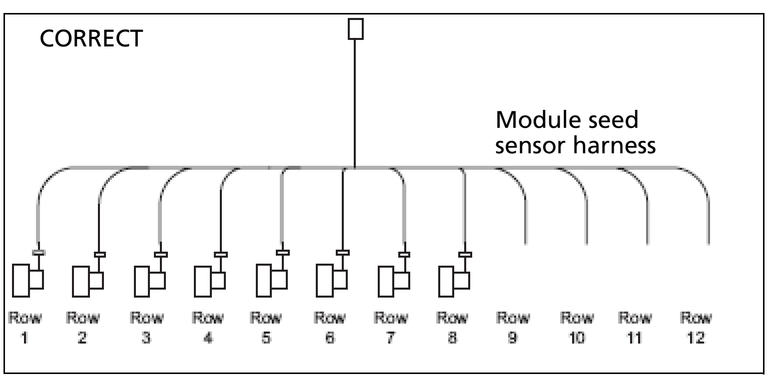
Seed sensors

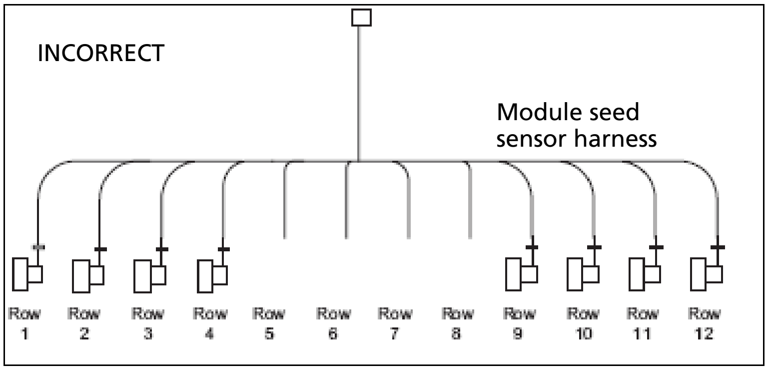
The system is compatible with DICKEY-john seed sensors. You can connect seed sensors to the WSMT module and all WSMB planter monitor modules. You can connect any number of sensors up to the maximum capacity of the module, with a maximum of 148 seed sensors connected to the system.

When connecting seed sensors to the modules, you must do the following:

- Connect all installed seed sensors to the seed sensor harness ***sequentially***, starting with the Row 1 input.
- If you will not use all of the row inputs on the module, the unused inputs must be the last inputs on ***that module:***







Failure to correctly install seed sensors will result in incorrect row assignment on the planter monitor display functions.

Hopper level sensors

The system is compatible with DICKEY-john hopper level sensors. The system supports the following number of hopper level sensors:

Application type	Maximum number of sensors
planter/drill	1
air seeding	4
granular application	3

RPM/Fan sensors

The system is compatible with DICKEY-john RPM/fan sensors. The system supports the following number of RPM/fan sensors:

Application type	Maximum number of sensors
planter/drill	1
air seeding	3
granular/spraying application	3

Air pressure sensors

The system is compatible with DICKEY-john air pressure sensors. The system supports the following number of air pressure sensors:

Application type	Maximum number of sensors
planter/drill	1
air seeding	4

Liquid pressure sensors

The system is compatible with DICKEY-john liquid pressure sensors for sprayers. The system supports the following number of liquid pressure sensors:

Application type	Maximum number of sensors
sprayer	4

Application rate sensors

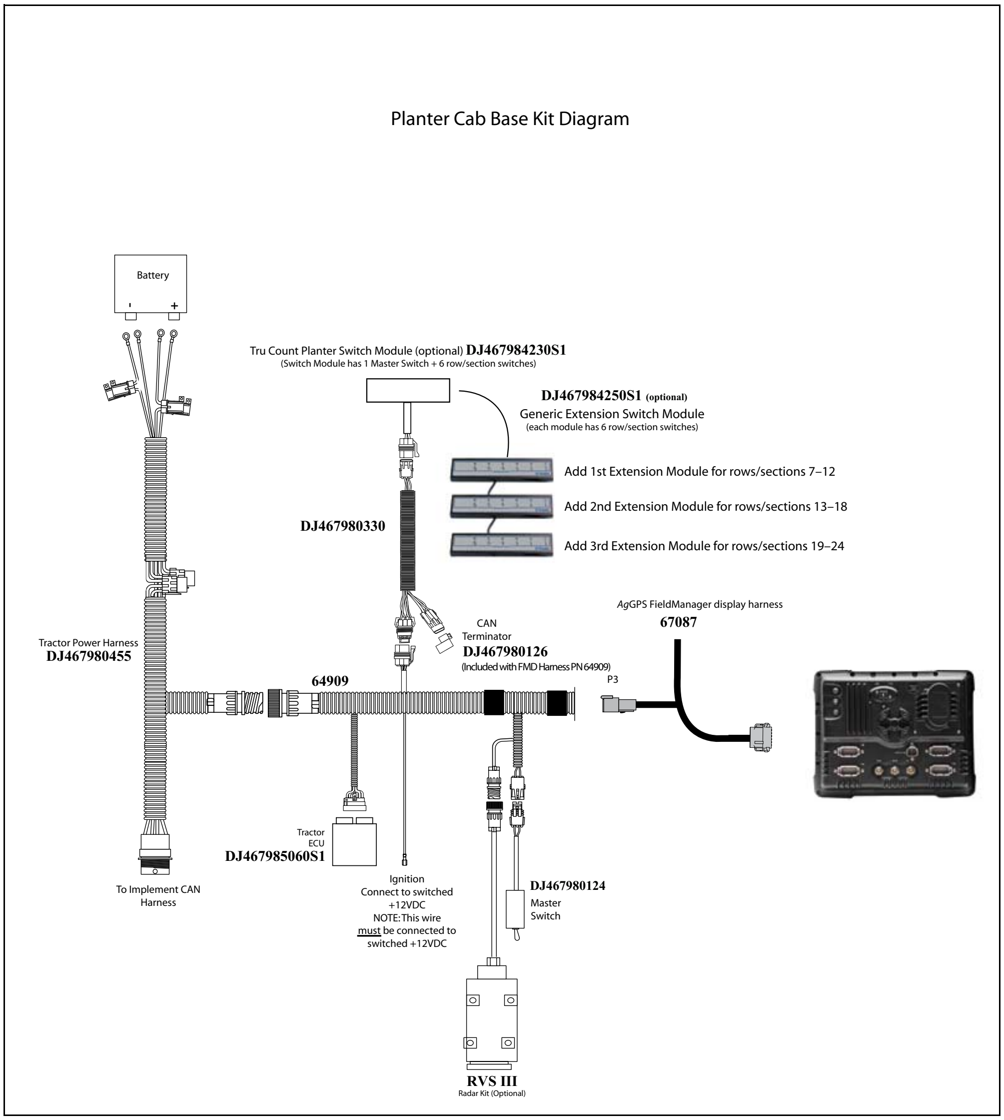
The system is compatible with DICKEY-john application rate sensors. The system supports the following number of application rate sensors:

Application type	Maximum number of sensors
planter/drill	4
air seeding	4
granular application	4

Installing the cab harness

Note – *The following harnesses are appropriate when installing the system in a planter. For information on installing the harnesses in a sprayer, air cart, spreader, or anhydrous unit, refer to the Flow and Application Ordering Guide.*

Planter cab base kit

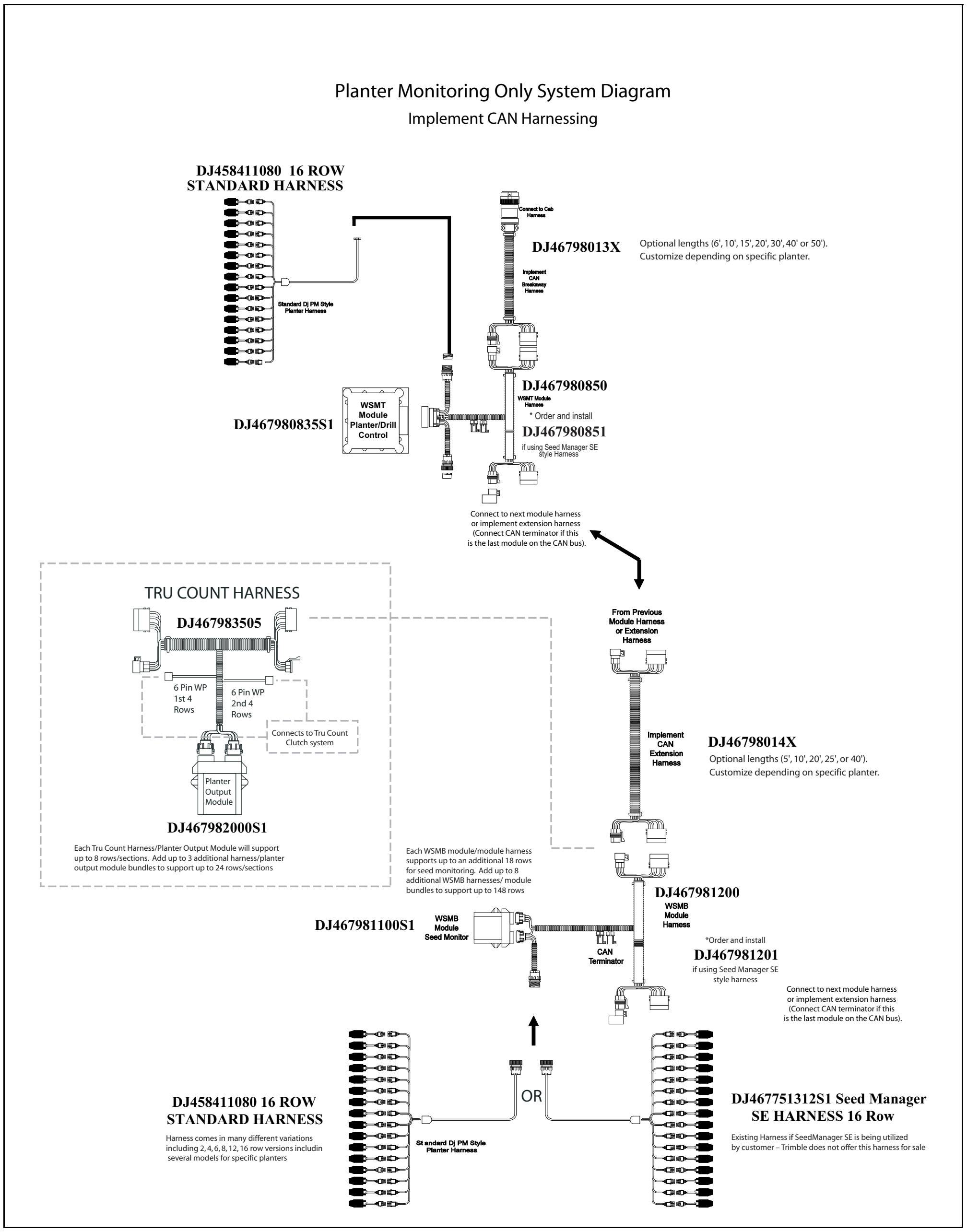


1. Connect the power leads directly to the battery. Connect the ignition wire to a switched +12 VDC.
2. Connect the chassis ground lead to a bare point of the cab frame that offers a good chassis ground connection. For the system to power correctly, you must connect the ignition lead to switched +12 VDC.
3. Connect the master switch, CAN terminator, and tractor ECU to their respective connectors on the cab harness.

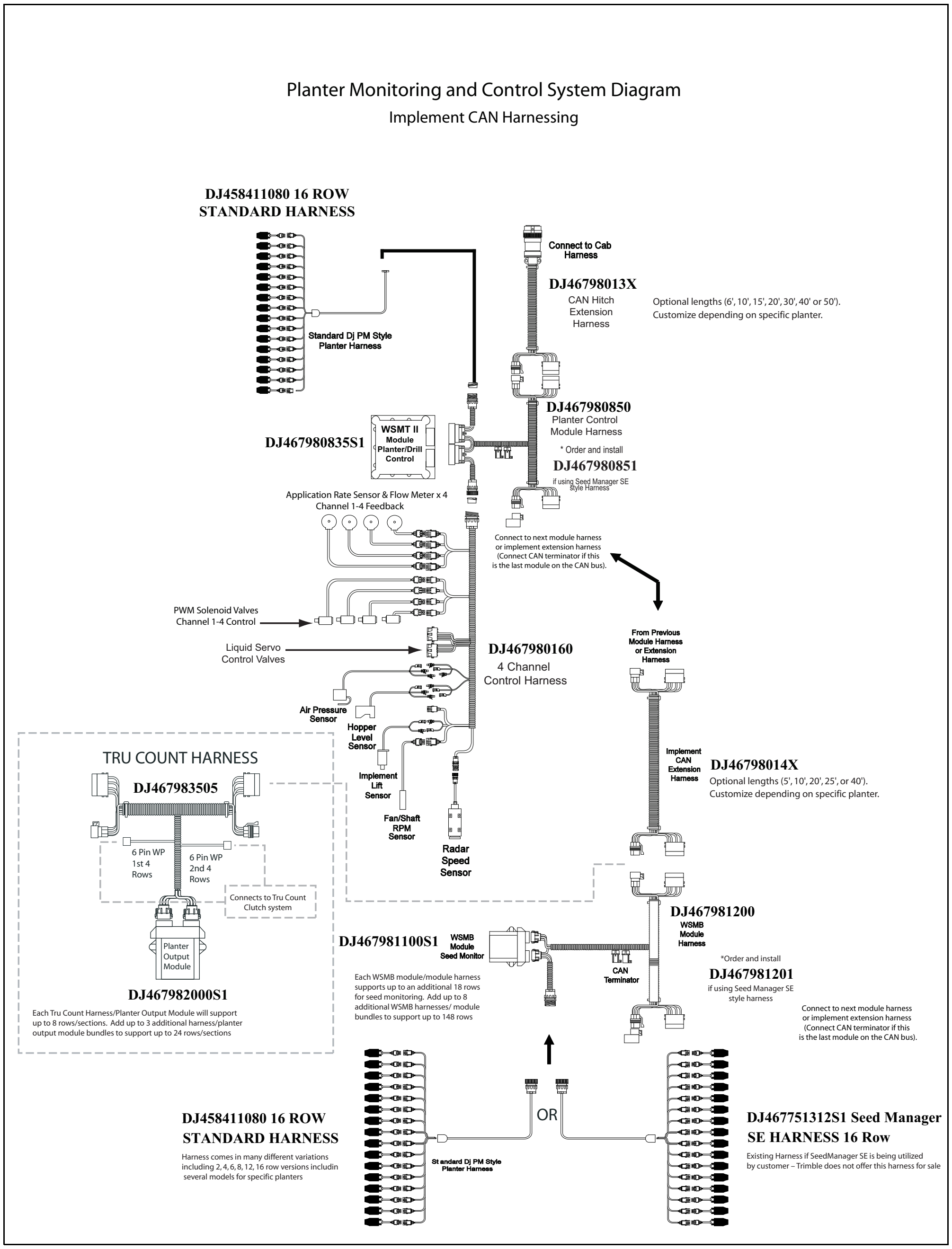
4. Connect the radar speed sensor, if required. If you connect the speed sensor to the WSMT, do not connect anything to the speed sensor connector on the cab harness.

Installing the implement harness

Planter monitoring only system diagram: Implement CAN harnessing



Planter monitoring and control system diagram: Implement CAN harnessing

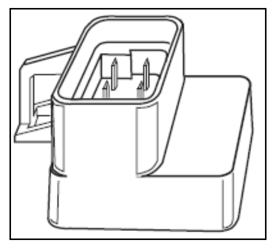


1. Lay the implement harness along the frame of the implement to each of the seed sensors. You are unlikely to require extensions.
2. Route the sensor wires to where they will not be damaged by parts of the implement.

3. Connect the implement CAN breakaway extension to the mating connector of the cab harness.
4. Secure the implement harness to the toolbar with tie-straps.
5. Coil and secure any unused sensor connections.
6. Route the implement harness along the implement hitch to the master module harness (if additional length is required, use an implement extension harness).
7. Secure the implement harness as needed.
8. Connect the master module harness to the mating connectors of the implement CAN harness and then connect the module to the implement harness. The member module uses a 48-pin connector with a jackscrew to secure the connector to the module. The WSMB uses a pair of 12-pin connectors.
9. Secure the module harness as needed.

CAN terminators

For the system to communicate correctly, you must install CAN terminators on cable ends:



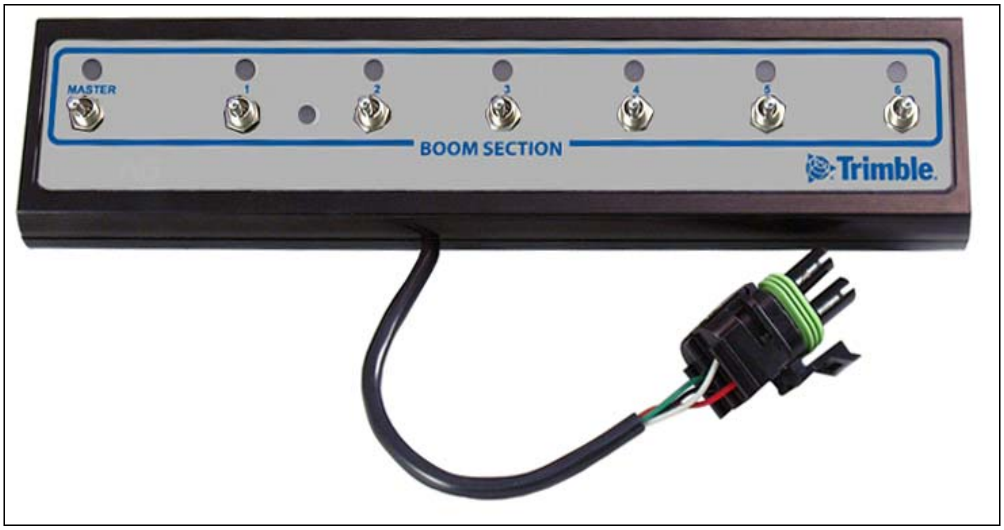
1. Install one terminator on the cab harness (P/N 64909).
2. Install one terminator plug into the implement harness of the last module connected to the CAN bus.

Installing additional equipment

Additional equipment is available to enable specific row/section control. For more information on installing a Tru Count Air Clutch, or boom section valves, contact the specific manufacturer.

Switch boxes

You can install switch boxes to control sprayer (BSM: boom switching module) and planting (CSM: clutch switching module) applications. These are boxes with switches that enable you or the system to turn individual sections on and off.



You can connect up to 4 switch boxes together so you have up to 24 switches. Install the switch boxes in a convenient place in the cab where you can comfortably reach them.

The system uses TCOM modules to control the switch outputs.

Other components

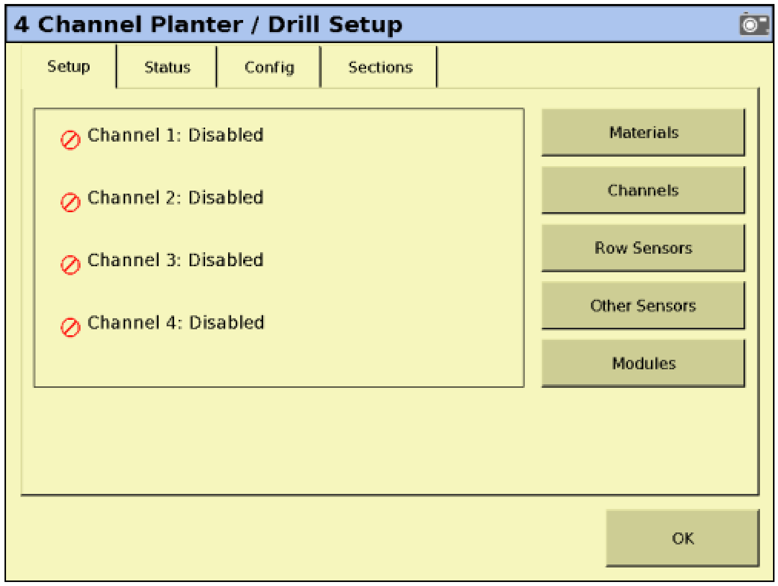
To install flow and application control components (for example, control valves or flow meters) refer to the instructions that are included with them.

Configuration: All models

1. Install the Tru Application Control plugin. See Adding or removing a plugin, page 194.
2. Configure the implement. For more information on configuring the implement, see the chapter Adjusting the implement settings, page 178.
3. Configure the spray boom. For more information on configuring the spray boom, see Configuring the spray boom (in the FM-1000 integrated display), page 531.

Configuring the plugin

1. From the *Configuration* screen, select the Tru Application Control plugin and then tap **Setup**:



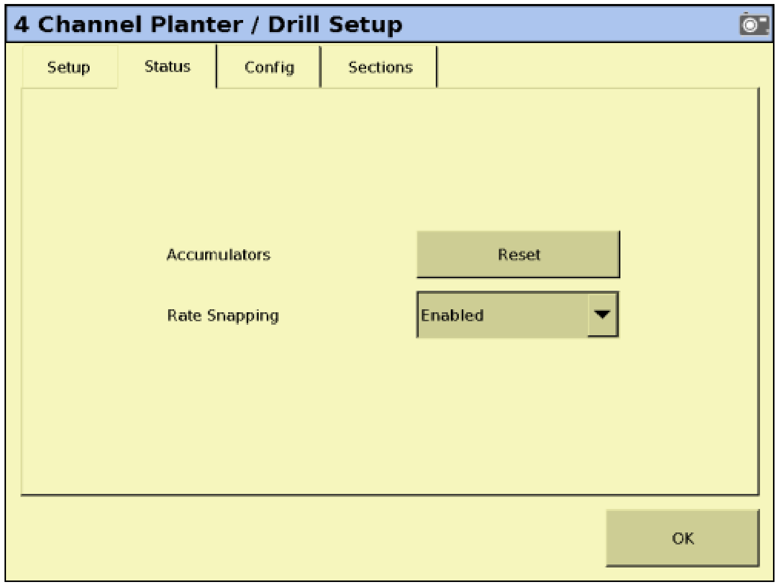
The first time that you configure the plugin, the channels are not set.

2. Configure each of the sections as described below.

Saving a configuration file

1. From the *4 Channel Setup* screen, tap **Backup Config**. The *Save Tru Application Control Configuration* screen appears.
2. Tap the *Filename* field to enter a new file name for the current configuration backup. Tap **OK** to create the backup file. The *Save Tru Application Control Configuration* screen appears.

3. Tap **OK** to save the configuration file. The *4 Channel Setup* screen appears:



Reloading a configuration file

When you reload a configuration, it restores all of the Tru Application Control plugin settings. Multiple backup files are supported so that you can save different configurations to support different modes and user preferences.

Configuring the modules

The implement is controlled by a ***master module*** that is usually mounted on the implement. The master module comes in five different configurations, depending on the required application:

- Planter/drill
- Air seeder/Strip-Till/NH3
- Sprayer
- Spreader

The master module stores all of the system settings and can control the following:

Master module type	Supports
Planter	Up to 16 seed sensors (the system can support up to 80 rows with the addition of member modules)
	Up to 4 control valves and 4 feedback sensors
	1 hopper level sensor
	1 air pressure or 1 RPM sensor
	1 implement lift switch
	GPS or radar-based speed sources
	Up to 24 Tru Count clutches (Requires the addition of 3 output modules/harnessing and 4 switch boxes)
Air seeder	Up to 4 control valves and 4 feedback sensors
	Up to 4 hopper levels sensors
	Up to 4 air pressure sensors
	Up to 3 RPM sensors
	1 implement lift switch
	GPS or radar-based speed sources
	Up to 148 seed sensors with the addition of member modules
	Support for up to 24 sections for row/boom control
	Up to 2 servo control valves and 2 feedback sensors
	1 implement lift switch
	GPS or radar-based speed sources
Sprayer	Up to 4 control valves and 4 feedback sensors
	Up to 4 liquid pressure sensors
	Up to 3 RPM sensors
	GPS or radar-based speed sensors
	Up to 24 boom section valves (Required the addition of 4 output modules/harnessing and 4 switch boxes)
Spreader	Up to 4 control valves and 4 feedback sensors
	Up to 3 hopper level sensors
	Up to 3 RPM sensors
	GPS or radar-based speed sources

To control more than 16 seed sensors, you can add additional modules called ***member modules***. You can have up to 8 member modules, and each member module can monitor up to 18 seed sensors. For air seeder blockage monitoring, this allows up to 148 rows of seed sensors in total (16 + (18 x 8)). The member modules pass information back to the master module. They can be installed anywhere on the implement.

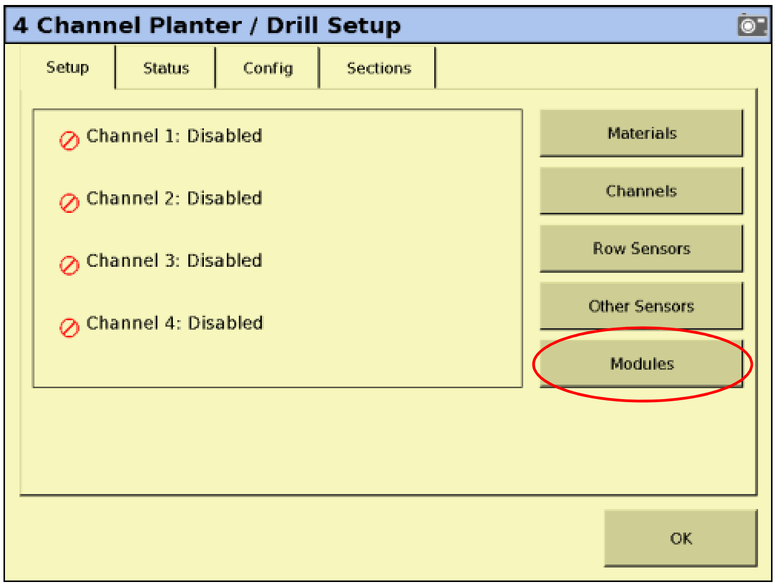
Note – *The air seeder* ***master*** *module does not directly accept seed sensors (all seed sensors must connect through the member modules). Therefore, air seeder master modules require a total of 9 member modules to reach the 148 row limit.*

You can do either of the following:

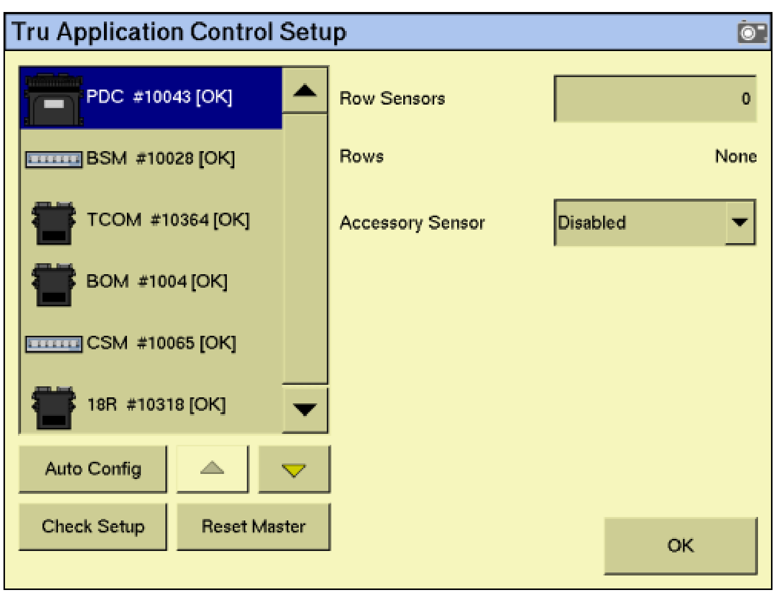
- **Auto Config**: Automatically configure the components that are connected. This replaces any current settings. See below.
- **Check Setup**: Send the current settings to the controller to be checked. See Checking the module setup, page 359.

Auto-configuring the modules

1. From the *4 Channel Setup* screen, tap **Modules**:



The *Tru Application Control Setup* screen appears:



The system can automatically configure the modules.

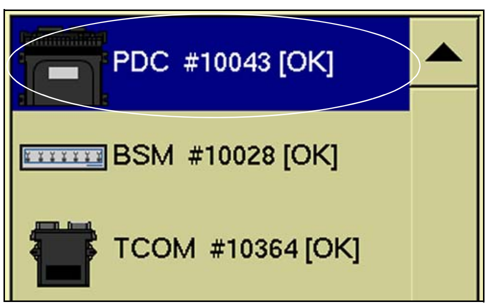
2. Ensure that all sensors are correctly connected to the modules.
3. Tap **Auto Config**. The display automatically detects how many:
   - Master, Member, and Output modules are connected
   - Seed sensors are attached to each module
   - Hopper sensors are connected to the system
   - Pressure sensors are connected to the system
   - RPM sensors are connected to the system
   - Switch boxes (BSM: Boom Switch Modules, or CSM: Clutch Switch Modules) are connected to the system

   The master module prefix changes to describe which sort you have:

Implement type	**Prefix**
Planter	PDC # *xxxxx*
Air seeder	AS # *xxxxx*
Sprayer	4CL # *xxxxx*
Fertilizer spreader	4CG # *xxxxx*
Anhydrous ammonia	NH3 # *xxxxx*

   Where *xxxxx* represents the module serial number.

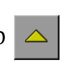
   In the following example, the master module is for an planter:



4. Ensure that the modules in the list appear in the order that they are connected to the harness. The master module is not necessarily the first module.

   For example, you may have rows 1–8 connected to a member module, while rows 9–16 are connected to the master. The module with rows 1–8 connected would come first in the list due to the row arrangement.

Tip – Trimble recommends that you arrange the modules, both physically and in the software, in order of their serial numbers.

   To reorder the list of modules, select a module and then tap  or  to move it up or down.

5. Select each module and then ensure that the number of sensors in the *Row Sensors* field is correct. If necessary, edit the number.

6. Select the master module and then select the connected accessory sensor in the *Accessory Sensor* list:

Item	Description
Disabled	No accessory sensor is connected.
Hopper sensors	The hopper level sensor is installed low in the seed tank or hopper and reports when the seed level drops to that point.
RPM Sensors	The sensor is a fan or shaft RPM sensor. If you select this option, RPM Sensor 1 is enabled in the *Other Sensor Setup* screen. You must manually configure the sensor there yourself.
Pressure Sensors	The sensor is an air pressure sensor. If you select this option, Pressure Sensor 1 is enabled and automatically configured in the *Other Sensor Setup* screen.
Liquid pressure sensors	The number of connected liquid pressure sensors is shown. You cannot adjust this setting.

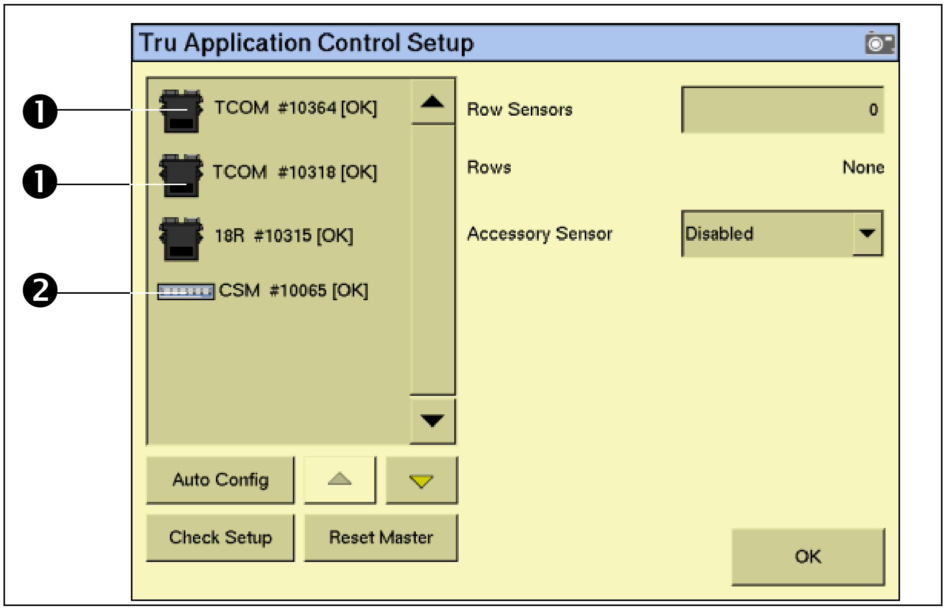
Note – *For a planter or drill, you can have only an RPM* ***or*** *an air pressure sensor. You cannot have both.*

Note – *The FM-1000 integrated display can show a maximum of six accessory sensors on the screen at once.*

7. Tap **OK**. The *4 Channel Setup* screen reappears.

Configuring the switch box(es)

Switch boxes enable you to use clutches to switch sections on and off. The system uses TCOM modules (or BOM modules for liquid) to control the switch boxes. The system automatically detects the number of outputs on the attached TCOM modules and then assigns those outputs to the switches available on the attached switch box(es):



Item	Description
❶	Automatically detected TCOM modules (or BOM modules for liquid)
❷	CSM (switch box) (BSM for liquid distribution)

In the example above, the system detected 16 outputs on the TCOM modules and 6 switches on the available CSM. On the CSM configuration screen, those 16 outputs are assigned to the 6 switches.

The first and last switches control two outputs, while the middle switches control three outputs. Where possible, the system assigns fewer outputs to the first and last switch so that the left and right sections that are most likely to turn on or off during overlap affect less of the width.

Switch box and module configuration is completed automatically. You cannot adjust it.

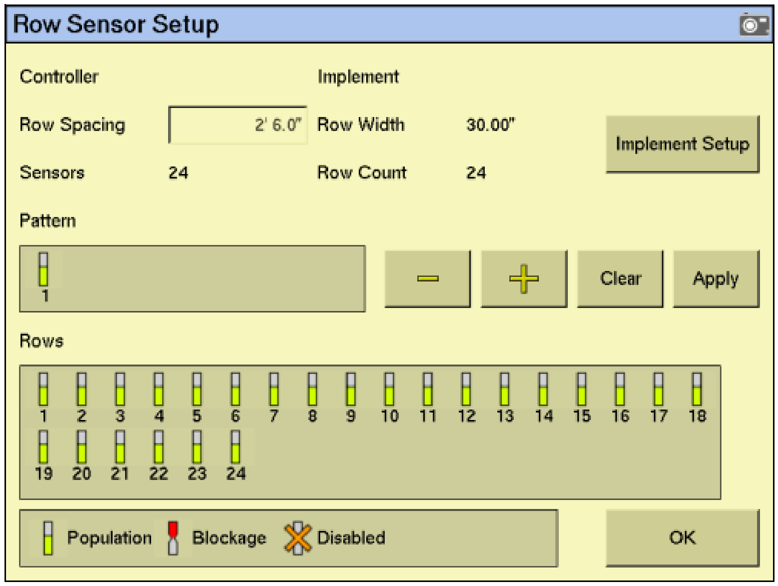
Checking the module setup

To send the current settings to the controller to check if they are correct, tap **Check Setup**.

If necessary, you can reset the master module from the *Tru Application Control Setup* screen. For more information, see Resetting the master module, page 461.

Configuring the row sensors on Planter/drill and air seeder modules

1. From the *4 Channel Setup* screen, tap **Row Sensors**:



This screen enables you to configure the sensors on the planter, drill, or air seeder rows. You can enable up to 148 rows.

The information at the top of the screen shows:

– The row width

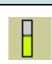
– The implement width

– The row count (based on the number of rows set in the implement setup)

– The number of sensors (based on the total number of sensors controlled by all the modules, as defined in the module setup)

2. If necessary, tap **Implement Setup** to configure the implement.

3. Set the rows. There are four possible settings for a sensor:

Heading	Appearance	Description
Population (ON)		The sensor is configured as a population or Hi Rate sensor that can count each seed as it passes the sensor. ***Note –*** *To use this option, a Hi Rate/population style seed sensor must be installed on the planter, drill, or air seeder.*
Blockage (ON)		The sensor is configured as a blockage type sensor that can detect seed passing by the sensor. When this option is selected, the user is notified when there is a blockage on a specific row; This style of seed sensor is not accurate enough to provide population information. ***Note –*** *To use this option, a blockage style seed sensor must be installed on the planter, drill, or air seeder.*

Heading	Appearance	Description
Disabled (OFF)		The row is disabled
Absent		The sensor is not there. ***Note –*** *You cannot select this setting; it is automatically assigned if the system does not detect a sensor.*

There are two ways to set the row sensors:

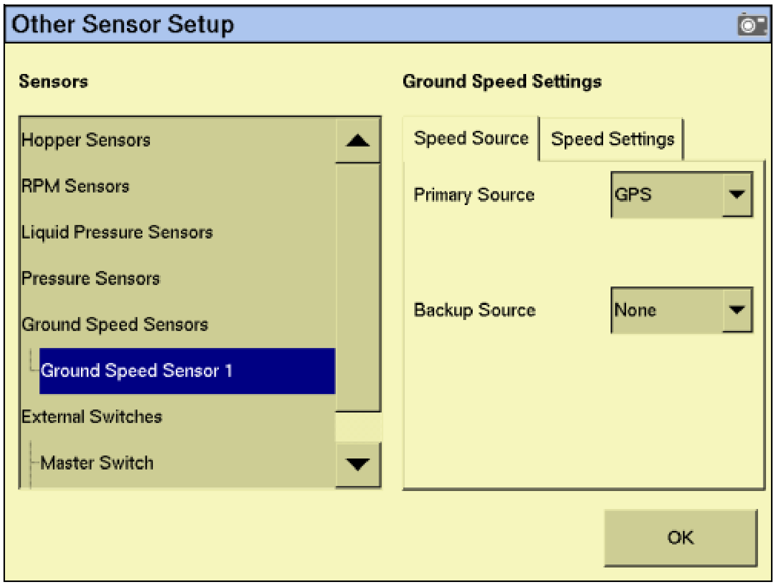
– You can use the *Pattern* group to apply a repeating pattern to the sensors. Tap **+** to add or **–** to remove a sensor until you have the correct number of sensors for the repeating pattern and then tap each sensor to adjust its setting. When the pattern is complete, tap **Apply**. The pattern you entered is applied to all sensors. To clear an existing pattern and start again, tap **Clear**.

– To adjust each sensor in the *Rows* group, tap it. To access additional sensors, tap .

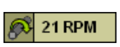
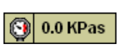
4. Tap **OK**.

Other sensors

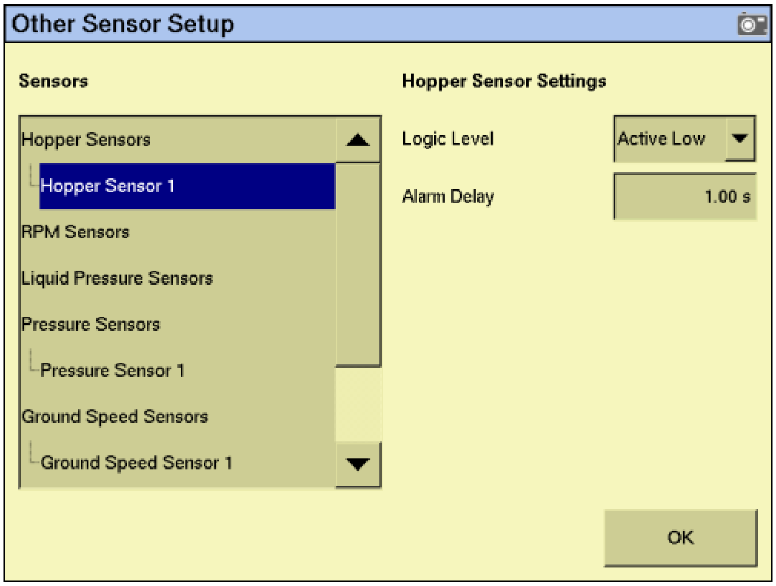
1. From the *4 Channel Setup* screen, tap **Other Sensors**:



There are five different types of sensor you can connect:

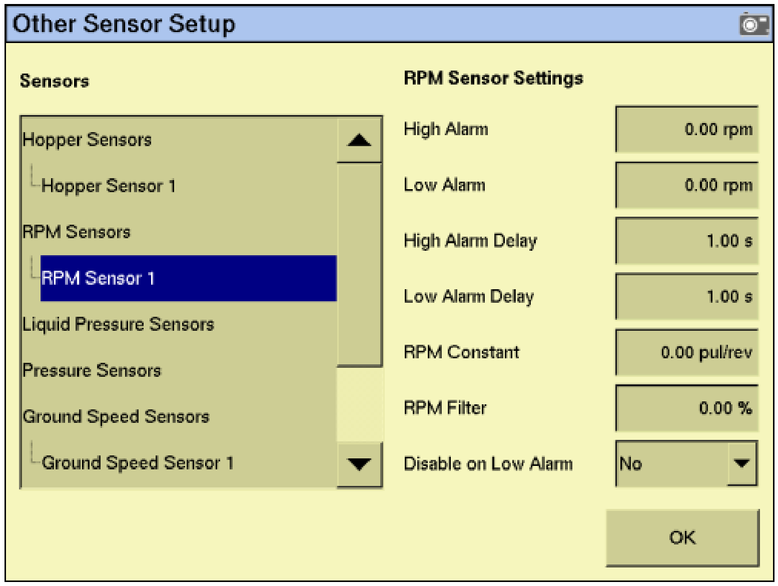
Sensor type	Description
Hopper Sensor 	A ***hopper*** sensor mounts inside a tank/bin and reports when that tank/bin is empty. The hopper sensor does not report the current level of the tank/bin—it reports when the product level drops below where the sensor is mounted. To monitor current tank levels, see Material accumulator, page 434.
RPM Sensor 	An RPM sensor monitors the speed of a shaft in an implement. It measures the number of shaft rotations per minute.
Pressure Sensor 	There are two types of pressure sensors that can be connected to the system: • An air pressure sensor measures the air or vacuum pressure within a tank for implements that use air to move product. • A liquid pressure sensor can be used in spraying applications to measure the liquid pressure at a given point within the system.
Ground Speed Sensor	There are three different types of ground speed sensors: • GPS • Radar • Manual input
External switch	The system can support two external switches: • a master switch that turns on or off operation (required) • an implement lift switch that turns on or off operation, depending on implement position

2. If a hopper sensor is connected, set the following:



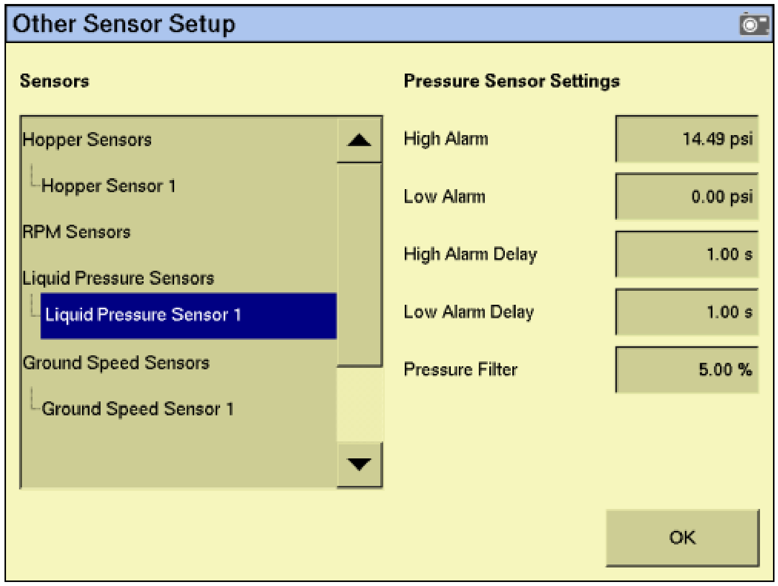
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>Logic Level</td><td>A hopper sensor outputs either a low condition when active or a high condition when active. Select the appropriate setting for your sensor:
• ACTIVE LO: An alarm is triggered when the sensor’s output is in a low state. Use this setting if the connected sensor outputs a low condition when active.
• ACTIVE HIGH: An alarm is triggered when the sensor’s output is in a high state. Use this setting if the connected sensor outputs a high condition when active.
Note – If the sensor is a DICKEY-john Hopper Level sensor, set the logic level to ACTIVE LO.</td></tr>
<tr><td>Alarm Delay</td><td>When a hopper alarm is triggered, the system waits for this length of time before reporting it. This can be useful for filtering out occasions when the alarm is briefly triggered. The value is entered in seconds.</td></tr>
</table>

3. If an RPM sensor is connected, set the following settings:



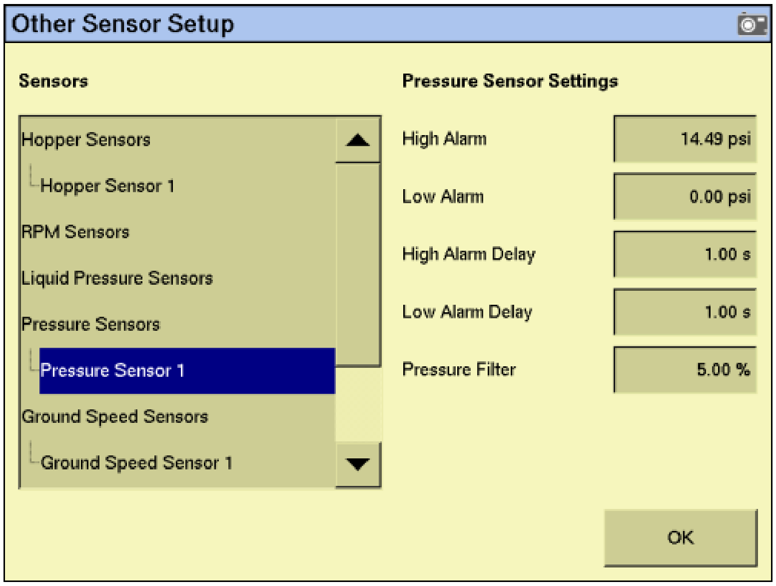
Setting	Description
High Alarm	If the RPM sensor detects a shaft RPM that is higher than this, a warning appears.
Low Alarm	If the RPM sensor detects a shaft RPM that is lower than this, a warning appears.
High Alarm Delay	You can set a delay so brief changes in shaft RPM speed do not trigger the warning. The High Alarm warning does not appear until the *High Alarm* limit is exceeded for this length of time.
Low Alarm Delay	You can set a delay so brief changes in shaft RPM speed do not trigger the warning. The Low Alarm warning will not appear until the *Low Alarm* limit is exceeded for this length of time.
RPM Constant	This is the number of pulses that the shaft speed sensor generates in one revolution of the monitored shaft. Typically, this is the number of teeth (sense points) on the gear attached to the monitored shaft. For example, for a gear with 12 teeth, enter **12.00**. If the sense gear is not directly attached to the monitored shaft, enter **0.01**.To disable the Shaft Speed function, enter **0.00**.
RPM Filter	The RPM filter value applies a filter to the signal from the RPM sensor. Typically, no filtering is required so the standard value is set at 0%. If the RPM readout on the Run screen oscillates in excess of 10%, increase the filter value to filter the signal to reduce the oscillation. For a true RPM value, set this number to 0%.
Disable on Low Alarm	• ENABLED: ***All*** of the control channels shut down if the RPM value of the selected sensor falls below the *Low Alarm* value. • DISABLED: Disables the function. The control channels continue to operate normally regardless of the RPM value.

4. If a liquid pressure sensor is connected, set the following settings:



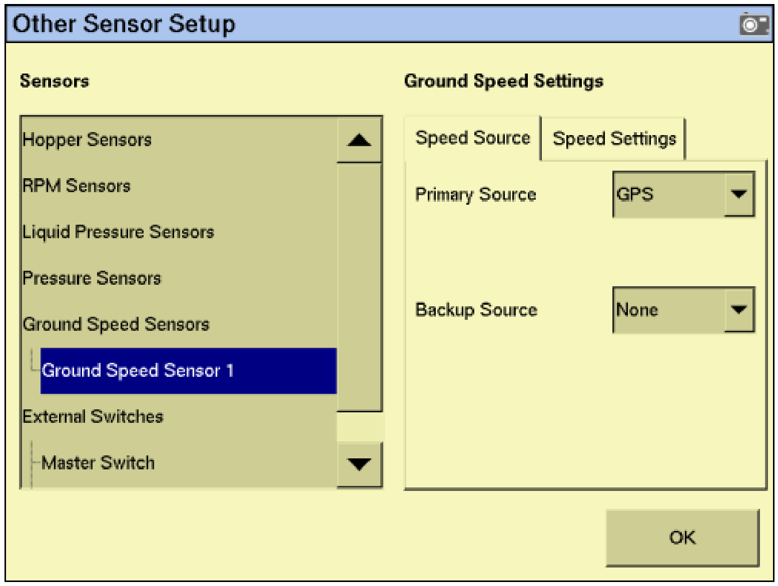
Setting	**Description**
Range	The pressure range that the sensor is capable of. Select DISABLED to disable the sensor.
High Alarm	If the liquid pressure sensor detects a pressure that is higher than this, a warning appears.
Low Alarm	If the liquid pressure sensor detects a pressure that is lower than this, a warning appears.
High Alarm Delay	You can set a delay so brief changes in pressure do not trigger the warning. The High Alarm warning does not appear until the *High Alarm* limit is exceeded for this length of time.
Low Alarm Delay	You can set a delay so brief changes in pressure do not trigger the warning. The Low Alarm warning does not appear until the *Low Alarm* limit is exceeded for this length of time.

5. If an air pressure sensor is connected, set the following settings:



Setting	Description
High Alarm	If the pressure sensor detects a pressure that is higher than this, a warning appears.
Low Alarm	If the pressure sensor detects a pressure that is lower than this, a warning appears.
High Alarm Delay	You can set a delay so brief changes in pressure do not trigger the warning. The High Alarm warning does not appear until the *High Alarm* limit is exceeded for this length of time.
Low Alarm Delay	You can set a delay so brief changes in pressure do not trigger the warning. The Low Alarm warning does not appear until the *Low Alarm* limit is exceeded for this length of time.
Pressure Filter	The *Pressure Filter* value applies a filter to the signal from the pressure sensor. Typically, no filtering is required so the standard value is set at 0%. If the pressure readout on the Run screen oscillates in excess of 10%, increase the filter value to filter the signal to reduce the oscillation. For a true pressure value, this number should be set to 0%.

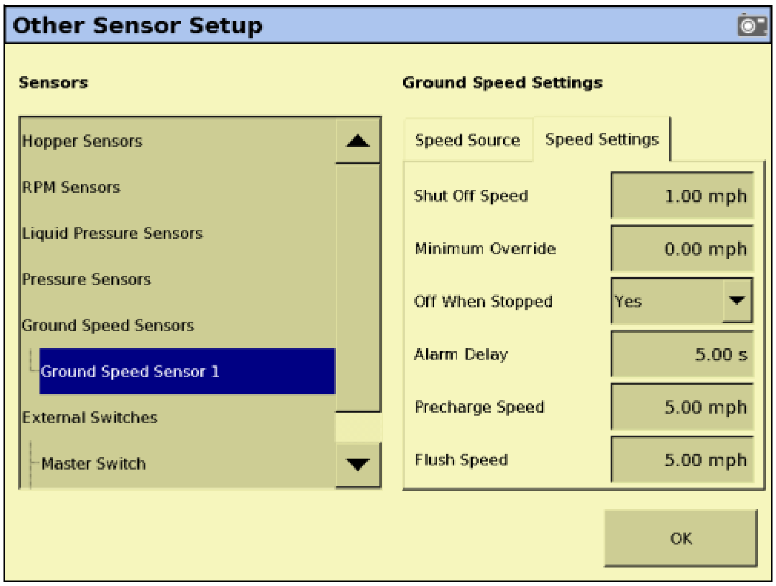
6. If a ground speed sensor is connected, set the following settings for the *Speed Source*:



Setting	Description
Primary Source	The primary source of ground speed information: • CAN ground – A radar/digital (3-wire) sensor is connected to the cab harness or a radar/forward ground speed sensor is connected to the CAN bus. • Digital Freq – A radar/digital (3-wire) sensor provides ground speed data through the 4 Channel Control (actuator) harness. • Reluct Freq – A reluctance (2-wire) sensor provides ground speed data through the 4 Channel Control (actuator) harness. • User Manual – Sets the system to operate using an internally generated ground speed. No ground speed sensor is required when using the *User Manual* setting. • GPS – Speed information is provided by the GPS system.
Backup Source	(Only available when the Primary Source is set to GPS) This is the secondary source of ground speed information: • CAN ground – Used when ground speed is provided by a radar/digital (3-wire) type sensor connected to the cab harness or if radar/forward ground speed is available on the CAN bus. • Digital Freq – Used when ground speed is provided by a radar/digital (3-wire) type sensor connected to the 4 Channel Control (actuator) harness. • Reluct Freq – Used when ground speed is provided by a reluctance (2-wire) type sensor connected to the 4 Channel Control (actuator) harness. • User Manual – Sets the system to operate using an internally generated ground speed. No ground speed sensor is required when using the *User Manual* setting.

Setting	Description
Speed Constant	(Only available when the Primary or Backup Source is set to CAN Ground, Digital Freq, or Reluct Freq) The constant required to convert the sensor data to the correct value. This is the number of pulses the sensor makes over a 400 ft distance. To calibrate this, see Ground speed constant, page 416.
Manual Speed	(Only available when the Primary or Backup Source is set to User Manual) The speed at which you want the control channel to run to if GPS- or Radar-based speed is not available. The control system will simulate the manual speed entered independent of your actual speed.

7. If a ground speed sensor is connected, set the following settings for the *Speed Settings:*



Setting	Description
Shut Off Speed	(***Not*** available when the Primary Source is set to User Manual.) The low speed that will cause the system to shut off.
Minimum Override	(***Not*** available when the Primary Source is set to User Manual.) When the vehicle ground speed drops below this level, the minimum override takes over and runs the system at this speed until the vehicle ground speed rises above this level or drops below the Shut Off Speed value and stops altogether.
Off When Stopped	When set to Yes the control valve will close when ground speed reaches 0 with the master switch position in On. When set to No the control valve will hold its last position when the master switch is shut off and ground speed reaches 0 *Example: With the setting set to "No", it allows a sprayer to maintain its last valve position while in headlands or in stopped conditions, allowing for agitation of the spray tank.*

Setting	Description
Alarm Delay	(***Not*** available when the Primary Source is set to User Manual.) When the ground speed drops to 0 but seed flow continues, the alarm triggers after this delay. This alarm triggers only when all control channels are disabled and the system is running in a planter monitor only mode.
Precharge Speed	Precharging is rotating the planter disk so that it is full of seed when you begin planting. This setting is the ground speed that the system uses when you perform a pre-charge while the vehicle is moving. (0 = Off).
Flush Speed	For Flush mode to work, the vehicle must not be moving. However, the system will flush solution as if the vehicle is traveling at this speed.

Configuring an external switch

A ***master switch*** is a switch installed in the vehicle cab that enables you to turn the implement on or off. A master switch is required for all applications. To calibrate it:

1. On the *Other Sensor Setup* screen, select Master Switch from the *Sensors* list.
2. From the *Switch Status* list, select *Installed*.
3. Set the *Timeout* value in seconds. When the vehicle ground speed drops to 0 and the master switch remains on, the system waits for this length of time and then stops operation. You must turn the Master switch off and on again to restart operation.

The optional implement lift switch provides On/Off control based on implement position. To enable it:

1. From the *Sensors* list, select *Implement Lift Switch*.
2. From the *Switch Status* list, select *Enabled*.
3. Tap **OK** and then tap **OK** again.

Continuing the configuration

The rest of the configuration process differs depending on the type of implement that the plugin will control:

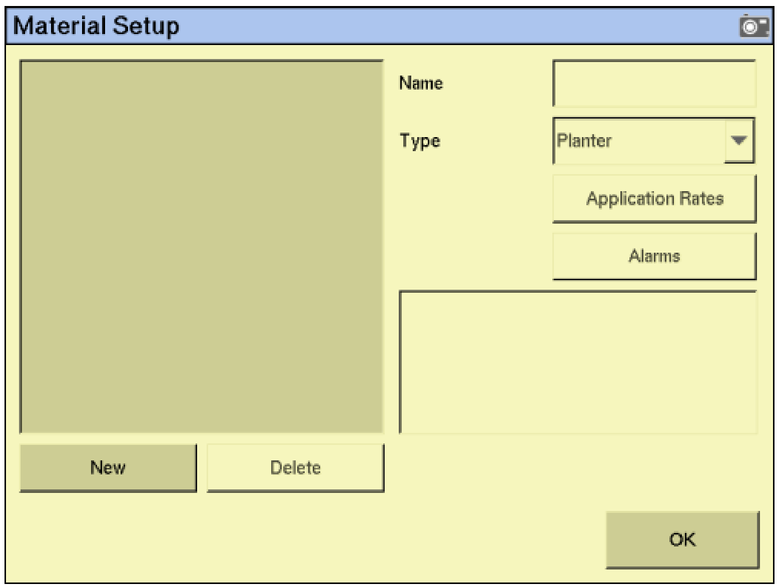
To configure…	See…
a planter (seed)	Configuring a planter, page 370
liquid flow	Configuring liquid flow, page 380
a drill or air seeder (granular seed)	Configuring granular seed, page 389
granular fertilizer/ material	Configuring granular fertilizer, page 398
an anhydrous unit	Configuring anhydrous, page 406

Configuring a planter

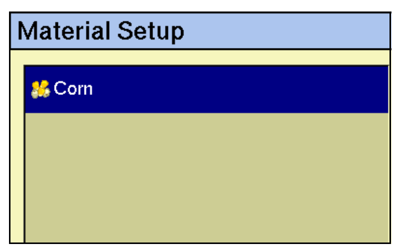
Entering materials

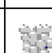
Enter the materials that the planter will apply. This may include different types of seed, liquid, or granular fertilizer.

1. From the *4 Channel Setup* screen, tap **Materials**:



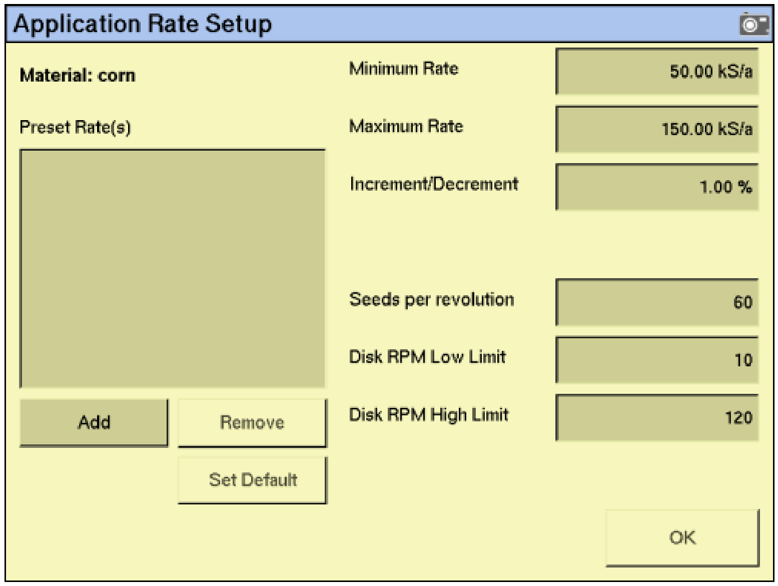
2. Tap **New**. The *Enter material name* screen appears.
3. Tap **CLEAR** and then enter a name that describes the material.
4. Tap **OK**. The *Material Setup* screen reappears with the new material in the list on the left of the screen.
5. In the *Type* list on the right of the screen, select the type of material. The icon beside the material name changes to reflect the type.



Product	Select...	Icon
Seed	Planter	
Liquid	Liquid Flow	
Granular seed	Granular Seed	
Granular fertilizer	Granular Fertilizer	

Note – *You must select the correct type, as this determines which options you see later in the setup process.*

6. Tap **Application Rates**:



Seed planting rates are measured in the following units:

Unit	Symbol	Description
Metric	kS/a	Thousand seeds per hectare
US/Imperial	kS/ha	Thousand seeds per acre

7. Enter the following values:

Item	Description
Minimum Rate	The minimum preset rate that the system will allow you to select.
Maximum Rate	The maximum preset rate that the system will allow you to select.
Increment/ Decrement	When you tap the **+** or **–** button on the Run screen planter tab, you increase or decrease the planter target rate. The *Increment/Decrement* value is the percentage that the target rate changes by.
Seeds per revolution	The number of seeds being planted per rotation of the seed disks.
Disk RPM Low Limit	The lowest disk RPM at which control channel will operate. The control will not allow the disk to rotate slower than this setting.
Disk RPM High Limit	The highest disk RPM at which control channel will operate. The control will not allow the disk to rotate faster than this setting.

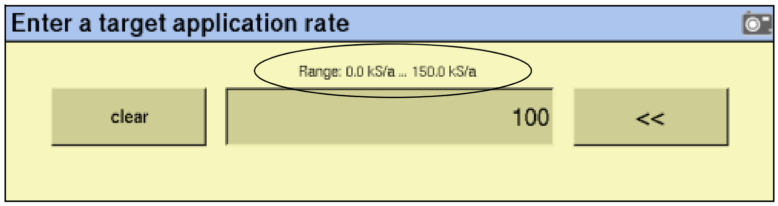
The ***target rate*** is the rate at which the planter will distribute this material. You must add at least one target rate before you can exit this screen.

8. To add a target rate:

   a. Tap **Add**. The *Enter a target application rate* screen appears.

   b. Tap **kS/ha** or **kS/a** as appropriate.

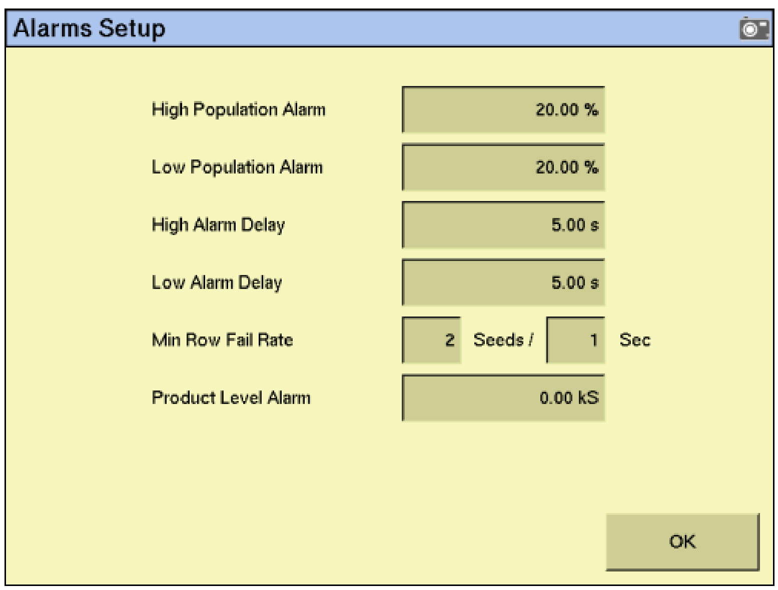
   c. Enter the new rate and then tap **OK**. The rate must be higher than the *Minimum Rate* and lower than the *Maximum Rate*. These limits are shown on the screen:



   d. Repeat this process to enter additional rates, if required. This enables you to switch between multiple rates on the Run screen. You can add up to eight preset target rates. If you create multiple rates, select the one that is to be the default rate and then tap **Set Default**.

9. Tap **OK**. The *Material Setup* screen reappears.

10. Tap **Alarms**:



11. Enter the alarm trigger rates:

Item	Description
High Population Alarm	When a sensor detects that the seed rate has risen to this percentage above the preset rate, a warning appears. For example, if the setting is 20%, the warning appears when the sensor detects that the seed rate has risen to 120% of the preset rate.
Low Population Alarm	When a sensor detects that the seed rate has fallen to this percentage below the preset rate, a warning appears. For example, if the setting is 20%, the warning appears when the sensor detects that the seed rate has fallen to 80% of the preset rate.
High Alarm Delay	This setting is in seconds. The alarm must be triggered constantly for this many seconds before it activates and alerts you of a high population.
Low Alarm Delay	This setting is in seconds. The alarm must be triggered constantly for this many seconds before it activates and alerts you of a low population.
Min Row Fail Rate	The rate of failure that is acceptable before the Row Fail alarm is triggered. Increase the number in the *Seeds* field to reduce the reporting of errors.
Product Level Alarm	The weight of product (Kg/lbs) that will trigger the low seed level alarm.

12. Tap **OK** and then tap **OK** again.

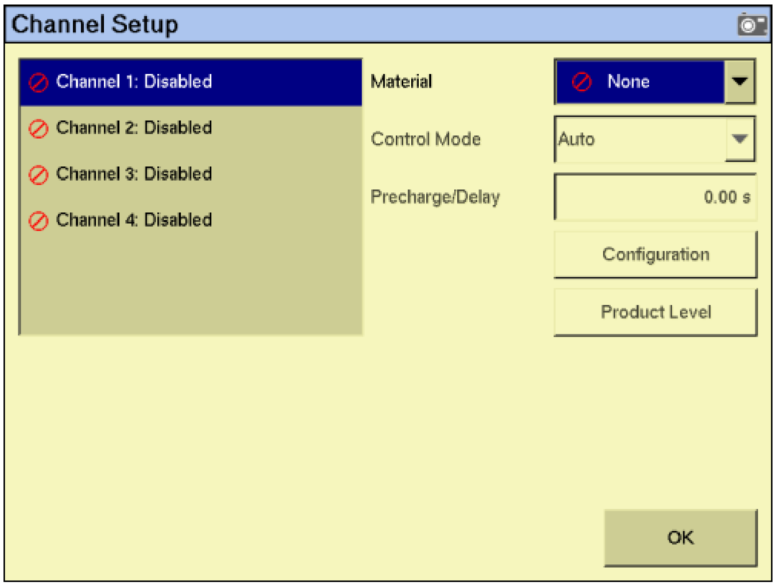
The material is now configured. Repeat this process to add an additional material.

Configuring the channels

Once you configure a material, you can configure the channels. The FM-1000 integrated display can control up to four channels of different materials at once.

To configure a channel for liquid or granular fertilizer, see page 383 or page 401 respectively.

1. From the *4 Channel Setup* screen, tap **Channels**:

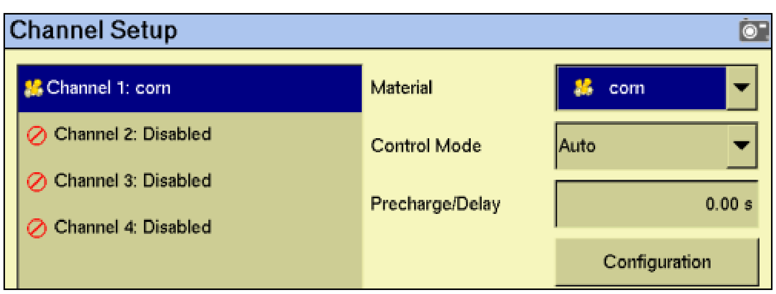


If you do not have population sensors to supply rate information (you only have block sensors), you can run the system in Monitor-only mode. For more information, see page 458.

2. From the list on the left, select a channel to configure.

The materials that you set up are available in the *Material* list.

3. From the list, select one of the materials.



Note – *The material being controlled must reflect the sequence of what is connected to the 4 channel control harness.*

4. Select the appropriate entry from the *Control Mode* list:

Item	Description
Auto	The control channel automatically calculates application rates and adjusts them according to speed under normal operating conditions.
Manual with Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease buttons on the Run screen, you adjust the Control Channel PWM% rate. The system shows the actual application rate being applied.
Manual w/out Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease buttons on the Run screen, you adjust the Control Channel PWM% rate. No application rate feedback is shown.
Monitor only	The system monitors seed population or row blockage and/or allows Tru Count row shut-off control when the system detects that auto rate control is being used.

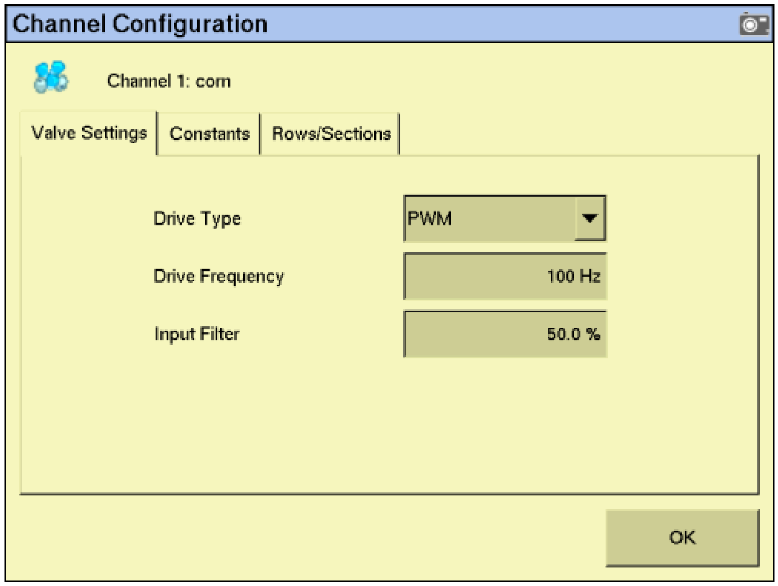
5. Change the *Precharge/Delay* setting, if necessary.

   The ***Precharge time*** is the length of time that a control channel will operate or be active when there is a minimum Precharge ground speed of greater than 1 (for precharge ground speed setup information, see Ground speed constant, page 416).

   Typically, the Precharge feature is used in applications with a significant distance between the storage bulk fill tank and the implement row unit, where seed/fertilizer travel time takes several seconds. The feature operates until the Precharge time lapses or the Precharge ground speed is exceeded. If ground speed stops while in Precharge mode, the Precharge feature aborts. Any time the Preset feature is established or changed and the Master Switch is turned on, a Precharge alarm appears.

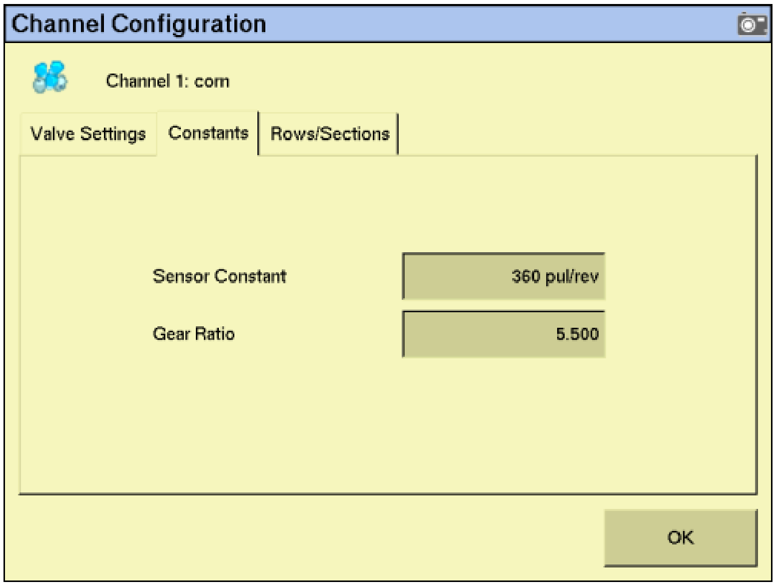
   After you turn on the master switch and lower the implement, the system waits for the ***delay time*** before the control channel starts operating. When you raise the implement or turn on the master switch, the system immediately shuts down the channel.

6. Tap **Configuration**. On the *Channel Configuration* screen, configure the *Valve Settings* as appropriate:



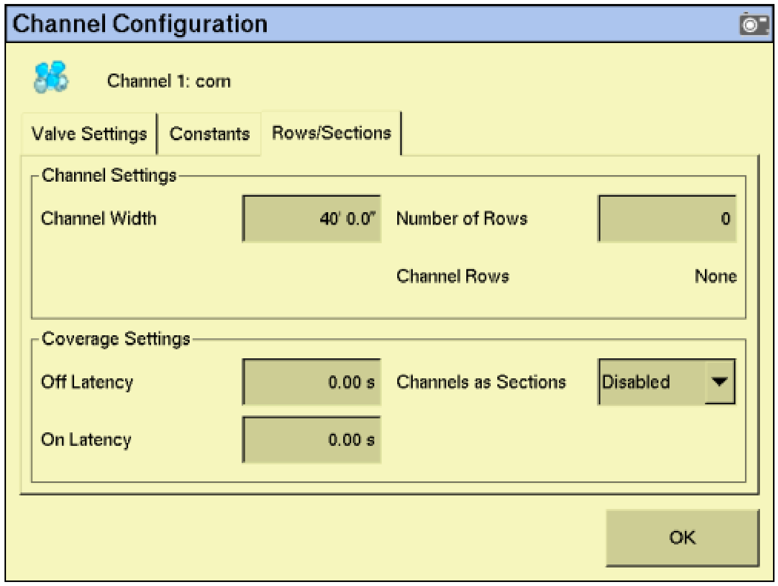
Item	Description
Drive Type	Select the planter drive type: • PWM – (Pulse Width Modulation) A proportional valve that varies the oil flow to a hydraulic motor based on the electric current supplied. This type of valve consists of a flow cartridge and coil assembly.
Drive Frequency	The frequency of the drive. This information is supplied by the drive manufacturer.
Input Filter	The amount of filtering that is applied to the flow meter feedback. Do not adjust this setting unless instructed to by Technical Support. Otherwise, you must calibrate the drive.

7. Configure the *Contants* as appropriate:



Item	Description
Sensor Constant	The number of pulses per revolution of the sensor. For DICKEY-john application rate sensors, set the value to 360.
Gear Ratio	Gear Ratio specifies the actual ratio from the application rate sensor to the seed meter shaft RPM. This is the number of revolutions the application rate sensor turns for each revolution of the seed meter.

8. Configure the *Rows/Sections* as appropriate:

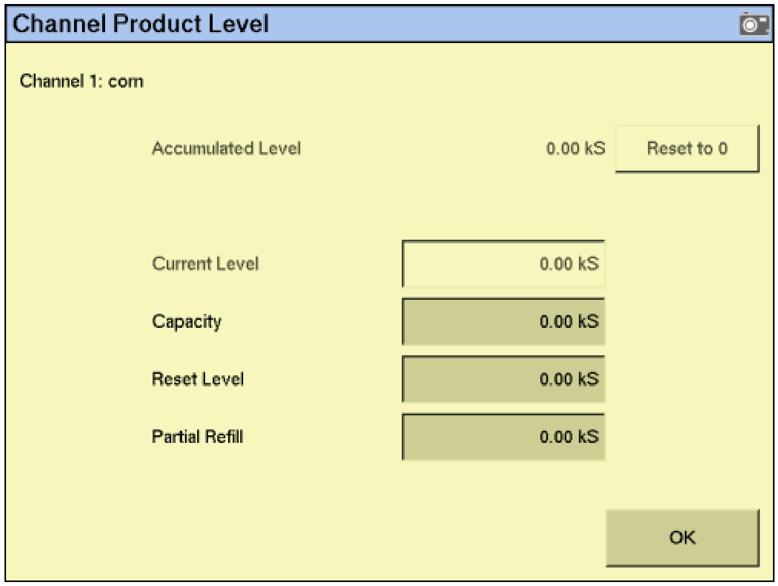


Item	Description
Channel Width	The combined width of the rows assigned to this channel.
Number of Rows	Enables entry of a specific number of seed rows to the control channel. Row assignment is given a priority based on the channel and is assigned sequentially thereafter. Channel 1 is always assigned to the first set of rows, Channel 2 to the next set of rows, and so on.
Off Latency	Measured in seconds and is the time it takes for the control channel to go from a running state to a stopped state. Enter a time here for the TAC system to automatically turn the channel off earlier to ensure that the system is off at the proper location when entering a covered area.
On Latency	Measured in seconds and is the time it takes for the control channel to go from a stopped state to a running state. Enter a time here for the TAC system to automatically turn the channel on earlier using the on latency value to ensure that the system is at operating speed when entering an uncovered area.
Channels as Sections	When enabled, the TAC system turns the control channel on and off automatically based on event coverage logging data.
New Toolbar	Appears when there are two or more channels of the same material type. When Enabled, this setting sets the second channel to be in parallel, or be stacked in relation to the first.

The system lists the rows currently used with these settings in the *Channel Rows* field.

9. Tap **OK**. The *Channel Setup* screen reappears.

10. Tap **Product Level**:



In this screen, you set the *Capacity*, *Reset Level*, and *Partial Refill* values so that you can quickly adjust the planter volume in the field.

Note *– You set the Current Level and Accumulated Level from the Run screen.*

11. Tap the *Capacity* field and then enter the number of seeds (in thousands) that the planter holds when full.
12. Tap the *Reset Level* field and then enter the number of seeds (in thousands) that the planter can be reset to, for example, if you only fill it to the halfway point. You must set the capacity for this setting to work.
13. Tap the *Partial Refill* field and then enter the number of seeds (in thousands) that you will add to the planter if you do a partial refill.
14. Tap **OK**. The *Channel Setup* screen reappears.
15. Repeat this process for Channels 2, 3, and 4, if necessary.

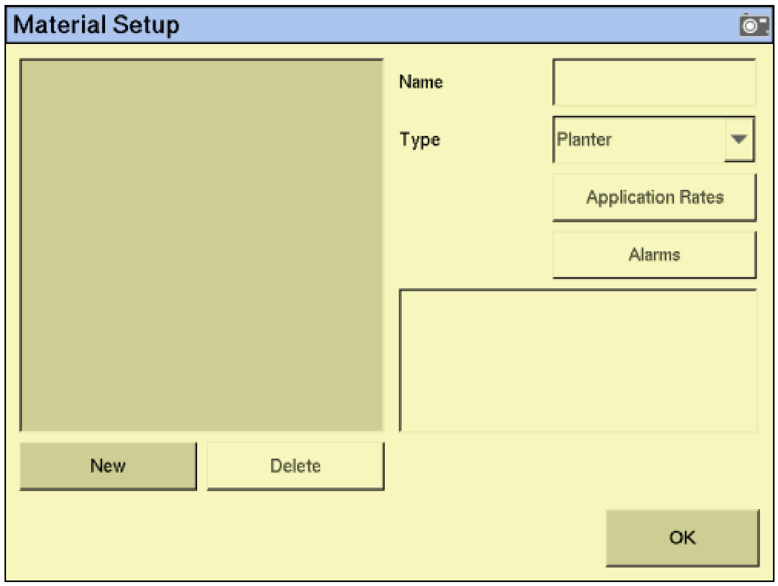
After you assign the materials to channels, see Combining channels, page 415.

Configuring liquid flow

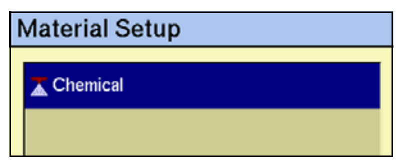
Entering materials

Enter the solution (material) that the implement or sprayer will distribute.

1. From the *4 Channel Setup* screen, tap **Materials**:



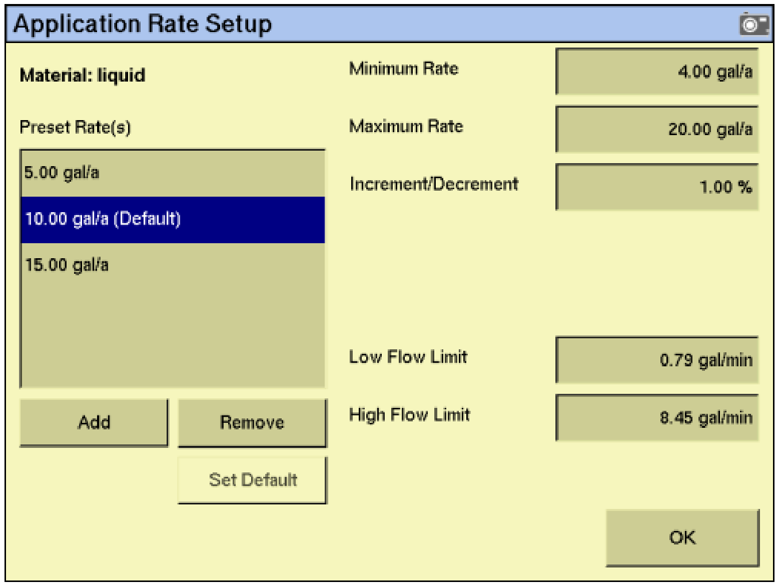
2. Tap **New**. The *Enter material name* screen appears.
3. Tap **CLEAR** and then enter a name that describes the material.
4. Tap **OK**. The *Material Setup* screen reappears with the new material in the list on the left of the screen.



5. In the *Type* list on the right of the screen, set the product type to Liquid Flow. The icon beside the material name changes to reflect the type: 

***Note** – You must select the correct type, as this determines which options you see later in the setup process.*

6. Tap **Application Rates**:



Liquid rates are measured in the following units:

Unit	Symbol	Description
Metric	L/ha	Liters per hectare
	L/min	Liters per minute
US/Imperial	gal/a	Gallons per acre
	gal/min	Gallons per minute

7. Enter the following values:

Item	Description
Minimum Rate	The minimum preset rate that the system will allow you to select.
Maximum Rate	The maximum preset rate that the system will allow you to select.
Increment/ Decrement	When you tap the **+** or **–** button on the Run screen tab, you increase or decrease the sprayer target rate. The Increment/Decrement value is the percentage that the target rate changes by.
Low Flow Limit	The lowest flow at which the system will operate.
High Flow Limit	The highest flow at which the system will operate.

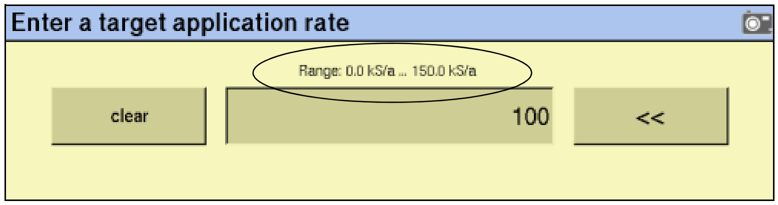
The ***target rate*** is the rate at which the implement or sprayer will distribute this material. You must add at least one target rate before you can exit this screen.

8. To add a target rate:

   a. Tap **Add**. The *Enter a target application rate* screen appears.

   b. Tap **kS/ha** or **kS/a** as appropriate.

c. Enter the new rate and then tap **OK**. The rate must be higher than the *Minimum Rate* and lower than the *Maximum Rate*. These limits are shown on the screen:



d. Repeat this process to enter additional rates, if required. This enables you to switch between multiple rates on the Run screen. You can add up to eight preset target rates. If you create multiple rates, select the one that is to be the default rate and then tap **Set Default**.

9. Tap **OK**. The *Material Setup* screen reappears.
10. Tap **Alarms**. The *Alarms Setup* screen appears.

    There is only one setting on the *Alarms Setup* screen for liquid flow.
11. Enter the product level alarm. When the solution in the tank drops to this level, a warning appears.
12. Tap **OK** and then tap **OK** again.

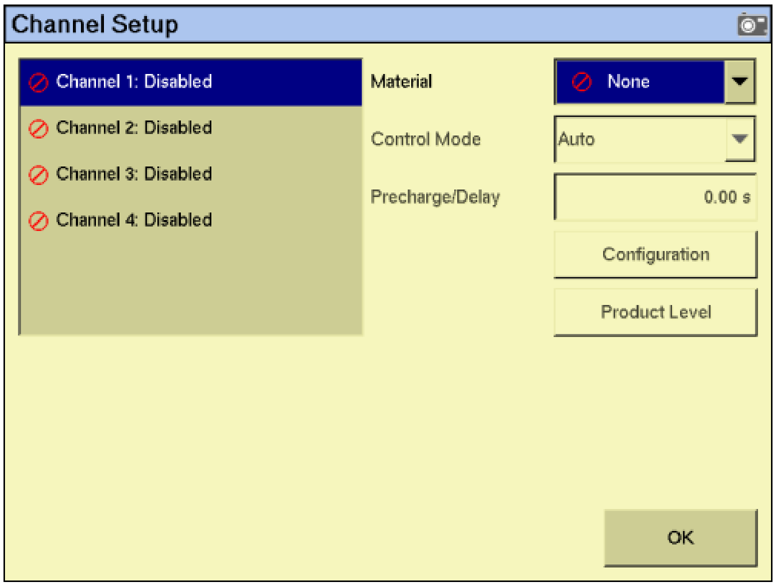
The material is now configured. Repeat this process to add an additional material.

Configuring the channels

Once you configure a material, you can configure the channels. The FM-1000 integrated display can control up to four channels of different materials at once.

Note – *The system can control a combination of four of the following: Up to two servo control valves and/or up to four PWM valves for a total of four valves controlled at once.*

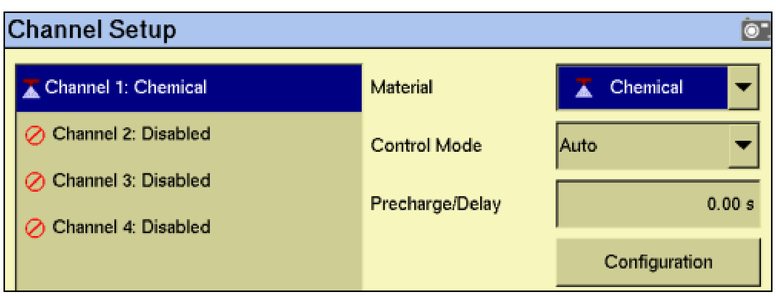
1. From the *4 Channel Setup* screen, tap **Channels**:



2. From the list on the left, select a channel to configure.

   The materials that you set up are available in the *Material* list.

3. From the list, select one of the materials:



Note – *The material being controlled must match the sequence of what is connected to the 4 channel control harness.*

4. Select the appropriate entry from the *Control Mode* list:

Item	Description
Auto	Control Channel automatically calculates application rates and adjusts according to speed under normal operating conditions.
Manual with Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease button on the Run screen, you adjust the Control Channel PWM% rate. The system shows the actual application rate being applied.
Manual w/out Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease buttons on the Run screen, you adjust the Control Channel PWM% rate. No application rate feedback is shown.

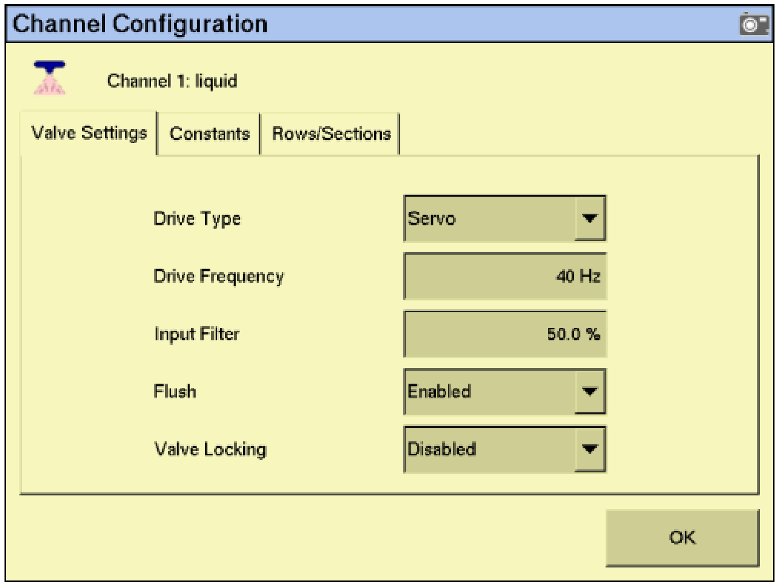
5. Change the *Precharge/Delay* setting, if necessary.

   The ***Precharge time*** is the length of time that a control channel will operate or be active when there is a minimum Precharge ground speed of greater than 1 (for precharge ground speed setup information, see Ground speed constant, page 416).

   Typically, the Precharge feature is used in applications with a significant distance between the storage bulk fill tank and the implement row unit, where seed/fertilizer travel time takes several seconds. The feature operates until the Precharge time lapses or the Precharge ground speed is exceeded. If ground speed stops while in Precharge mode, the Precharge feature aborts. Any time the Preset feature is established or changed and the Master Switch is turned on, a Precharge alarm appears.

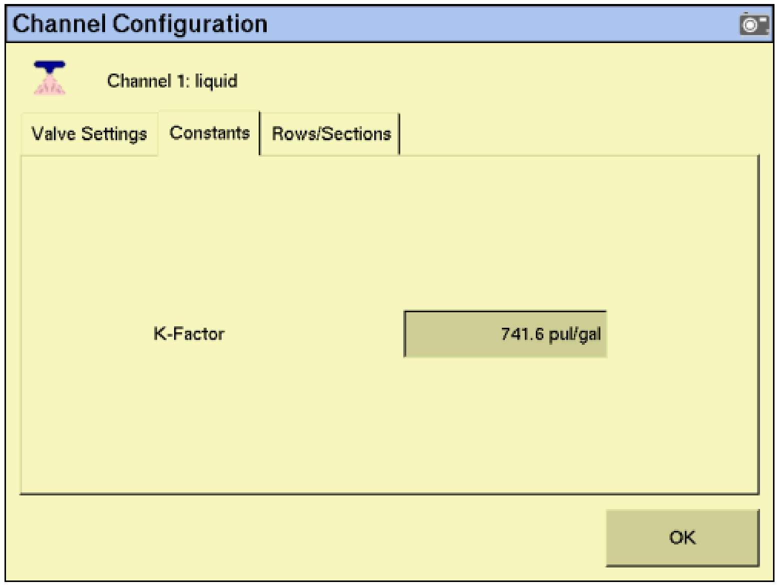
   After you turn on the master switch and lower the implement, the system waits for the ***delay time*** before the control channel starts operating. When you raise the implement or turn on the master switch, the system immediately shuts down the channel.

6. Tap **Configuration**. On the *Channel Configuration* screen, configure the *Valve Settings* as appropriate:



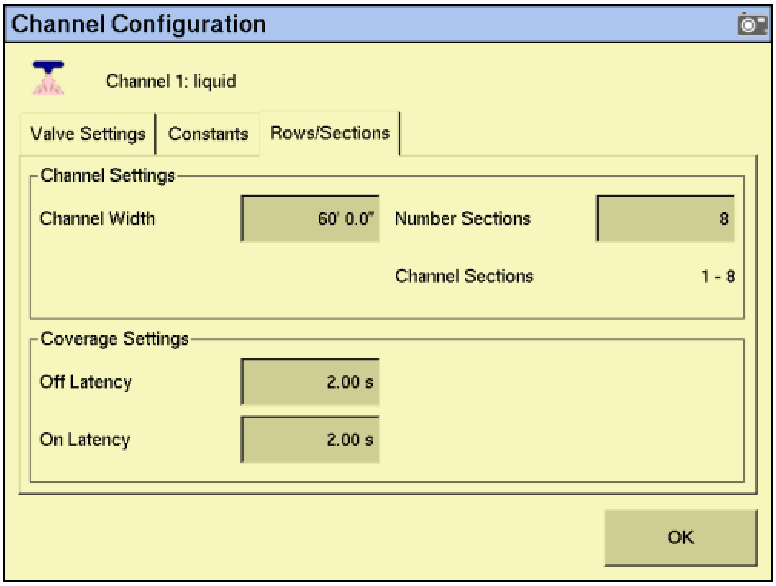
Item	**Description**
Drive Type	Select the liquid drive type: • PWM – (Pulse Width Modulation) A proportional valve that varies the oil flow to a hydraulic motor based on the electric current supplied. This type of valve consists of a flow cartridge and coil assembly. • Servo – A ball valve or butterfly valve driven by an electric motor gearbox and installed in the main product delivery line. • Servo Return – A ball valve or butterfly valve driven by an electric motor gearbox and installed in the tank return line.
Drive Frequency	The frequency of the drive. This information is supplied by the drive manufacturer.
Input Filter	The amount of filtering that is applied to the flow meter feedback. If you adjust this setting, you must calibrate the drive.
Flush	Flush Enable is a manual override mode that opens the valve and dispenses granular fertilizer, granular seed, or liquid material for a period of time in relation to a user-defined flush speed. The Flush Enable feature can only be activated when the tractor is stopped. You should have already configured the rate at which Flush dispenses when you configured the ground sensor. See Other sensors, page 362.
Valve Locking	Valve locking locks the valves in their last position when the booms are turned off. Use this mode to maintain pressure when doing turns and for tank agitation. If valve locking is not required, set the *Valve Locking* setting to Not Installed.

7. Configure the *Constants* tab as appropriate:



Item	Description
K-Factor	The number of pulses per liter (or gallon) that the sensor produces. • If you already know the K-Factor, enter it here. • If you do not know the K-Factor, perform a flow-meter calibration. See Flow meter constant, page 421. • If the system has a Raven flow meter, divide the number by 10 and then enter the result as the K-Factor.

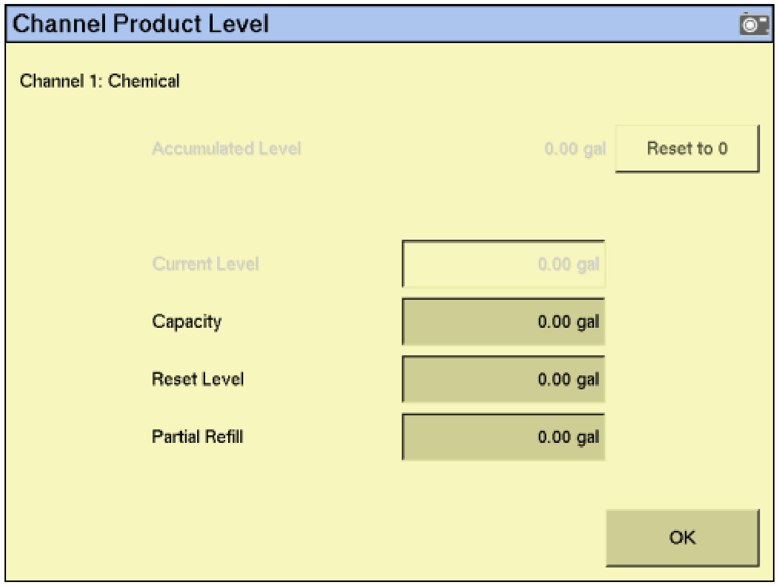
8. Configure *Rows/Sections* tab as appropriate:



Item	Description
Channel Width	The combined width of the rows assigned to this channel.
Number of Rows	Enables entry of a specific number of seed rows to the control channel. Row assignment is given a priority based on the channel and is assigned sequentially thereafter. Channel 1 is always assigned to the first set of rows, Channel 2 to the next set of rows, and so on.
Off Latency	Measured in seconds and is the time it takes for the control channel to go from a running state to a stopped state. Enter a time here for the TAC system to automatically turn the channel off earlier to ensure that the system is off at the proper location when entering a covered area.
On Latency	Measured in seconds and is the time it takes for the control channel to go from a stopped state to a running state. Enter a time here for the TAC system to automatically turn the channel on earlier using the on latency value to ensure that the system is at operating speed when entering an uncovered area.

9. Tap **OK**. The *Channel Setup* screen reappears.

10. Tap **Product Level**:



On this screen, you set the *Capacity*, *Reset Level*, and *Partial Refill* values, so that you can quickly adjust the sprayer volume in the field.

Note – *You set the Current Level and Accumulated Level from the Run screen.*

11. Tap the *Capacity* field and then enter the volume (in Liters or gallons) that the implement/sprayer holds when full.
12. Tap the *Reset Level* field and then enter the volume (in Liters or gallons) that the implement/sprayer can be reset to, for example, if you only fill it to the halfway point. You must set the capacity for this setting to work.
13. Tap the *Partial Refill* field and then enter the volume (in Liters or gallons) that you will add to the implement/sprayer if you do a partial refill.
14. Tap **OK**. The *Channel Setup* screen reappears.
15. Repeat this process for Channels 2, 3, and 4, if necessary.

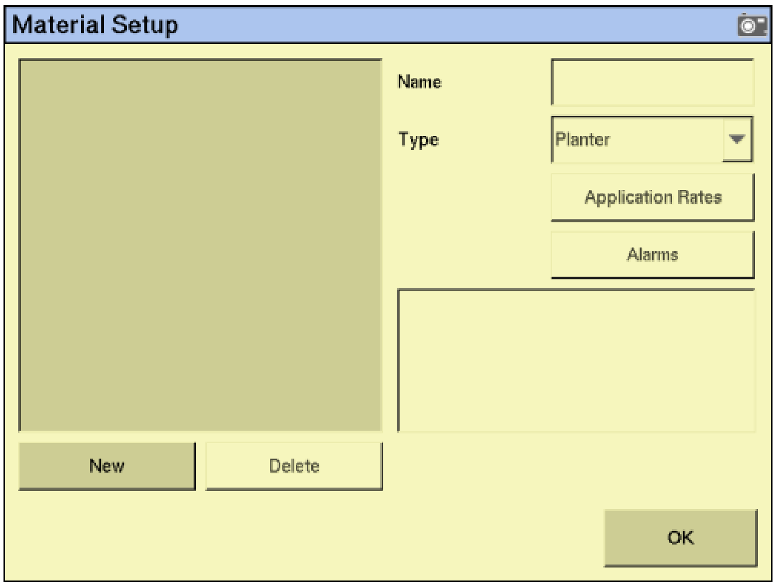
After you assign the materials to channels, see Combining channels, page 415.

Configuring granular seed

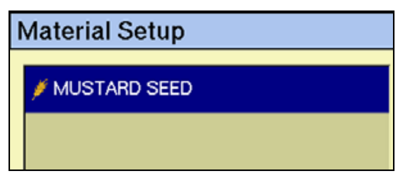
Entering materials

Enter the materials that the drill/seeder will plant.

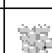
1. From the *4 Channel Setup* screen, tap **Materials**:



2. Tap **New**. The *Enter material name* screen appears.
3. Tap **CLEAR** and then enter a name that describes the material.
4. Tap **OK**. The *Material Setup* screen reappears with the new material in the list on the left of the screen.

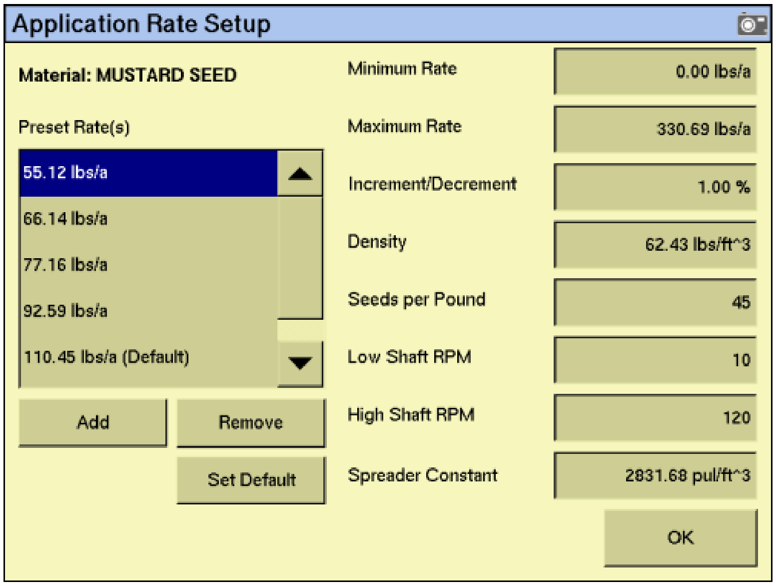


5. In the *Type* list on the right of the screen, set the product type. The icon beside the material name changes to reflect the type.

Product	Select…	Icon
Seed	Planter	
Liquid	Liquid Flow	
Granular seed	Granular Seed	
Granular fertilizer	Granular Fertilizer	

***Note –** You must select the correct type, as this determines which options you see later in the setup process.*

6. Tap **Application Rates**:



Granular seed distribution rates are measured in the following units:

Unit	Symbol	Description
Metric	kg/ha kg/l	Kilograms of seeds per hectare Kilograms per liter (density)
US/Imperial	lbs/a lbs/ft^3	pounds of seeds per acre pounds per cubic foot (density)

7. Enter the following values:

Item	Description
Minimum Rate	The minimum preset rate that the system will allow you to select.
Maximum Rate	The maximum preset rate that the system will allow you to select.
Increment/ Decrement	When you tap the **+** or **–** button on the Run screen channel tab, you increase or decrease the granular seeder target rate. The *Increment/Decrement* value is the percentage that the target rate changes by.
Density	The weight per volume of the material to dispense.
Seeds per Pound	The number of seeds per pound. This is used to convert the current application rate to kS/ha (kS/a).
Low Shaft RPM	The lowest shaft speed at which the control channel will operate.
High Shaft RPM	The highest shaft speed at which the control channel will operate.
Spreader Constant	Each material has its own constant that is the number of application rate sensor pulses per liter (cubic ft) of material. ***Note –*** *Ensure that this is as accurate as possible. Using the Spreader Constant Calibration wizard is recommended. See Spreader constant, page 423.*

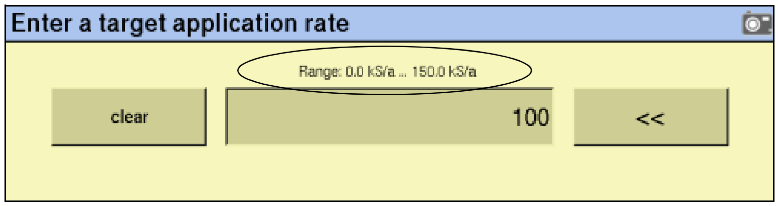
The ***target rate*** is the rate at which the implement will distribute this material. You must add at least one target rate before you can exit this screen.

8. To add a target rate:

   a. Tap **Add**. The *Enter a target application rate* screen appears.

   b. Tap **kS/ha** or **kS/a** as appropriate.

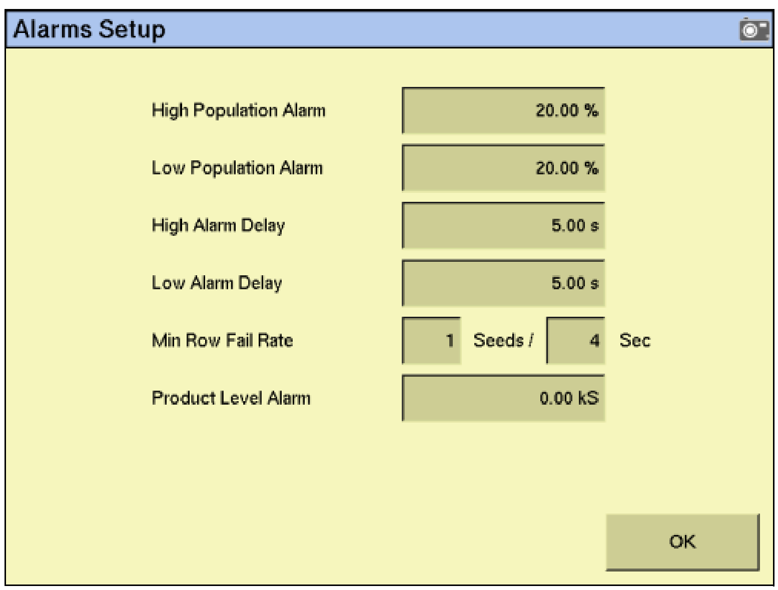
   c. Enter the new rate and then tap **OK**. The rate must be higher than the *Minimum Rate* and lower than the *Maximum Rate*. These limits are shown on the screen:



   d. Repeat this process to enter additional rates, if required. This enables you to switch between multiple rates on the Run screen. You can add up to eight preset target rates. If you create multiple rates, select the one that is to be the default rate and then tap **Set Default**.

9. Tap **OK**. The *Material Setup* screen reappears.

10. Tap **Alarms**:



11. Enter the alarm trigger rates:

Item	Description
High Population Alarm	When a sensor detects that the seed rate has risen to this percentage above the preset rate, a warning appears. For example, if the setting is 20%, the warning appears when the sensor detects that the seed rate has risen to 120% of the preset rate.
Low Population Alarm	When a sensor detects that the seed rate has fallen to this percentage below the preset rate, a warning appears. For example, if the setting is 20%, the warning appears when the sensor detects that the seed rate has fallen to 80% of the preset rate.
High Alarm Delay	This setting is in seconds. The alarm must be triggered constantly for this many seconds before it activates to alert you of a high population.
Low Alarm Delay	This setting is in seconds. The alarm must be triggered constantly for this many seconds before it activates to alert you of a low population.
Min Row Fail Rate	The rate of failure that is acceptable before the Row Fail alarm is triggered. Increase the number in the *Seeds* field to reduce the reporting of errors.
Product Level Alarm	When the product gets down to this level, a warning is triggered.

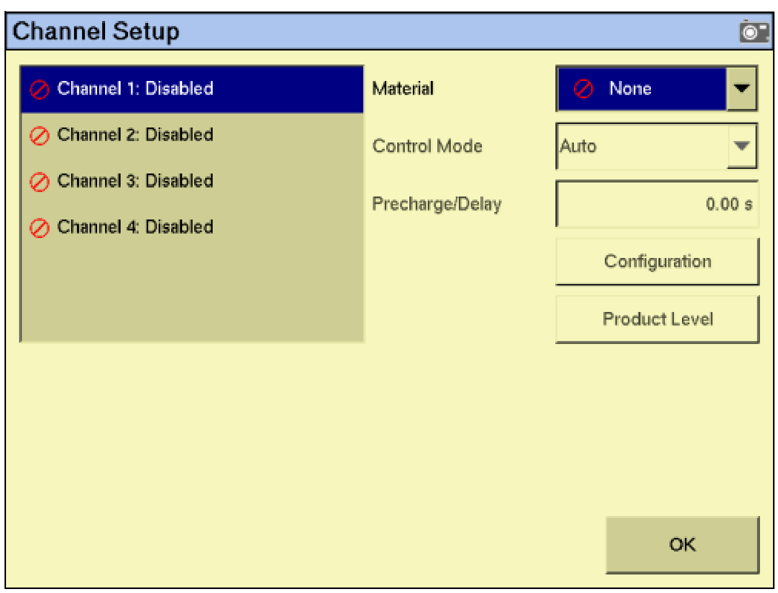
12. Tap **OK** and then tap **OK** again.

The material is now configured. Repeat this process to add an additional material.

Configuring the channels

Once you configure a material, you can configure the channels. The FM-1000 integrated display can control up to four channels of different materials at once.

1. From the *4 Channel Setup* screen, tap **Channels**:

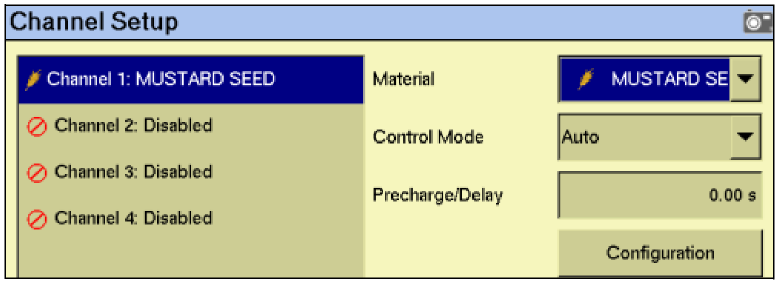


If you do not have population sensors to supply rate information (you only have block sensors), you can run the system in Monitor-only mode. For more information, see page 458.

2. From the list on the left, select a channel to configure.

   The materials that you set up are available in the *Material* list.

3. From the list, select one of the materials:



***Note** – The material being controlled must match the sequence of what is connected to the 4 channel control harness.*

4. Select the appropriate entry from the *Control Mode* list:

Item	Description
Auto	The Control Channel automatically calculates application rates and adjusts according to speed under normal operating conditions.
Manual with Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease button on the Run screen, you adjust the Control Channel PWM% rate. The system shows the actual application rate being applied.
Manual w/out Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease buttons on the Run screen, you adjust the Control Channel PWM% rate. No application rate feedback is displayed.

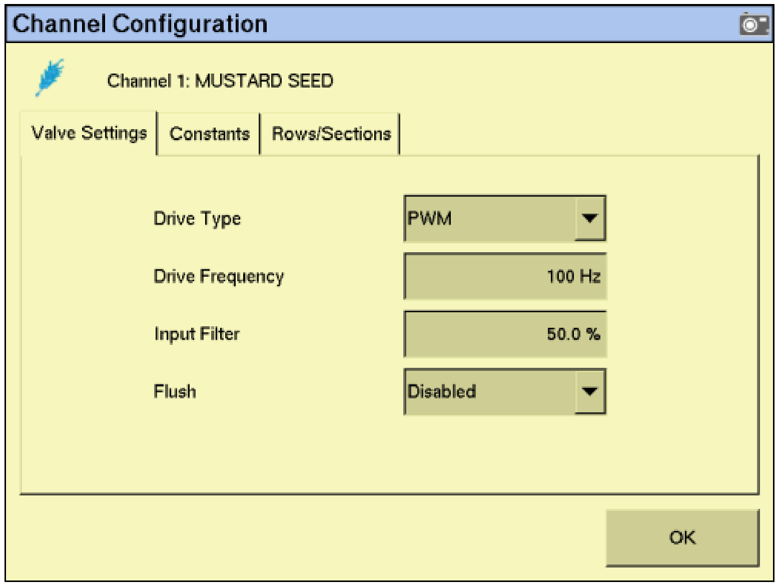
5. Change the *Precharge/Delay* setting, if necessary.

   The ***Precharge time*** is the length of time that a control channel will operate or be active when there is a minimum Precharge ground speed of greater than 1 (for precharge ground speed setup information, see Ground speed constant, page 416).

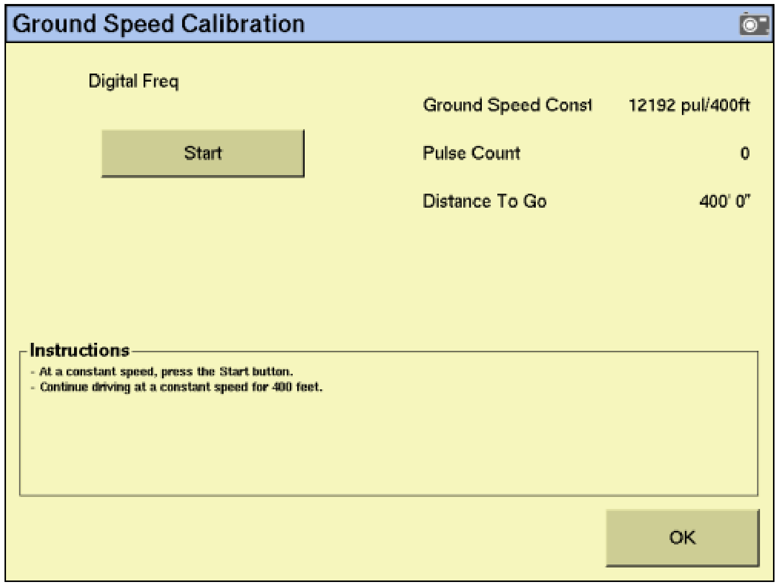
   Typically, the Precharge feature is used in applications with a significant distance between the storage bulk fill tank and the implement row unit, where seed/fertilizer travel time takes several seconds. The feature operates until the Precharge time lapses or the Precharge ground speed is exceeded. If ground speed stops while in Precharge mode, the Precharge feature aborts. Any time the Preset feature is established or changed and the Master Switch is turned on, a Precharge alarm appears.

   After you turn on the master switch and lower the implement, the system waits for the ***delay time*** before the control channel starts operating. When you raise the implement or turn on the master switch, the system immediately shuts down the channel.

6. Tap **Configuration**. Configure the appropriate *Valve Settings*:



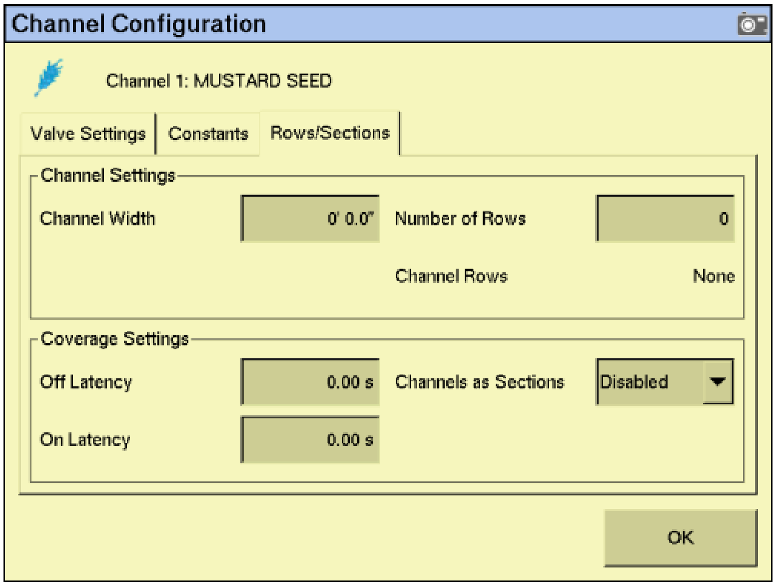
Item	Description
Drive Type	Select the granular seeder drive type: • PWM – (Pulse Width Modulation) A proportional valve that varies the oil flow to a hydraulic motor based on the electric current supplied. This type of valve consists of a flow cartridge and coil assembly. • Servo – A ball valve or butterfly valve driven by an electric motor gearbox and installed in the main product delivery line.
Drive Frequency	The frequency of the drive. This information is supplied by the drive manufacturer.
Input Filter	The amount of filtering that is applied to the flow meter feedback. If you adjust this setting, you must calibrate the drive.
Flush	Simulates operation to clear the system of unwanted product.



7. Configure the appropriate settings for the *Constants*:

Item	Description
Sensor Constant	The number of pulses per revolution of the sensor. For DICKEY-john application rate sensors, set the value to 360.0.
Gear Ratio	The ratio of the number of turns of application rate sensor to each turn of the seed meter.

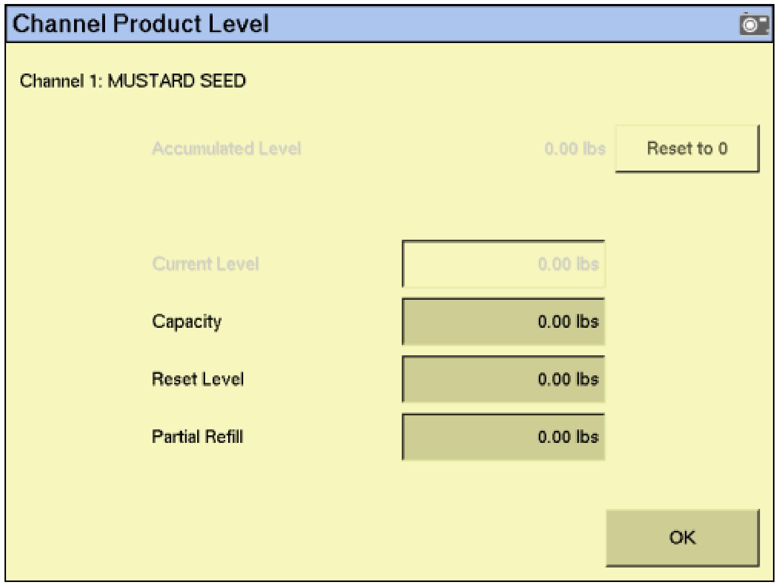
8. Configure the appropriate *Row/Sections* settings:



Item	Description
Channel Width	The combined width of the rows assigned to this channel.
Number of Rows	The specific number of seed rows for the channel. Channel 1 will always be assigned to the first set of rows, Channel 2 to the next set of rows, and so on.
Off Latency	Measured in seconds and is the time it takes for the control channel to go from a running state to a stopped state. Enter a time here for the TAC system to automatically turn the channel off earlier to ensure that the system is off at the proper location when entering a covered area.
On Latency	Measured in seconds and is the time it takes for the control channel to go from a stopped state to a running state. Enter a time here for the TAC system to automatically turn the channel on earlier using the on latency value to ensure that the system is at operating speed when entering an uncovered area.
Channels as Sections	When enabled the TAC system will turn the control channel on and off automatically based on event coverage logging data.

9. Tap **OK**. The *Channel Setup* screen reappears.

10. Tap **Product Level**:



On this screen, you set the *Capacity*, *Reset Level*, and *Partial Refill* values so that you can quickly adjust the drill/seeder volume in the field.

***Note** – You set the Current Level and Accumulated Level from the Run screen.*

11. Tap the *Capacity* field and then enter the weight of seeds (in kilograms or pounds) that the drill/seeder holds when full.
12. Tap the *Reset Level* field and then enter the weight of seeds (in kilograms or pounds) that the drill/seeder can be reset to, for example, if you only fill it to the halfway point. You must set the capacity for this setting to work.
13. Tap the *Partial Refill* field and then enter the weight of seeds (in kilograms or pounds) that you will add to the drill/seeder if you do a partial refill.
14. Tap **OK**. The *Channel Setup* screen reappears.
15. If necessary, repeat this process for Channels 2, 3, and 4.

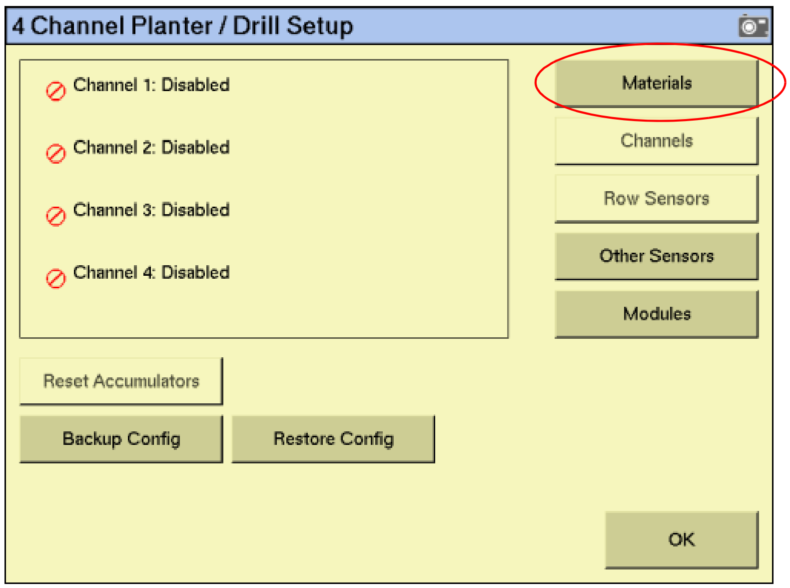
Once you assign the materials to channels, see Combining channels, page 415.

Configuring granular fertilizer

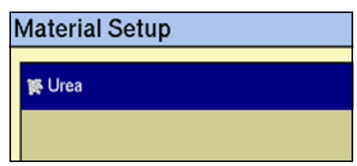
Entering materials

Enter the materials that the planter or spreader will apply. This may include different types of fertilizer or other granular materials.

1. From the *4 Channel Setup* screen, tap **Materials**:



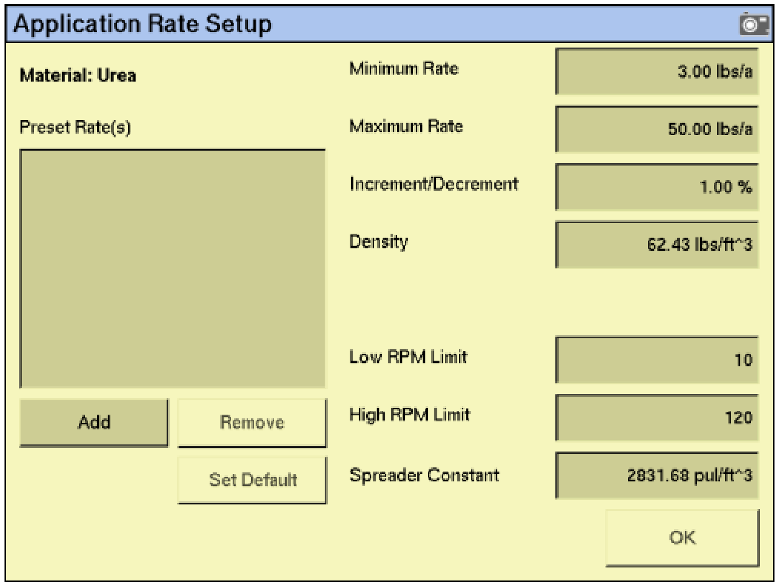
2. In the *Material Setup* screen, tap **New**. The *Enter material name* screen appears.
3. Tap **CLEAR** and then enter a name that describes the material.
4. Tap **OK**. The *Material Setup* screen reappears with the new material in the list on the left of the screen.



5. In the *Type* list on the right of the screen, set the type of material to Granular Fertilizer. The icon beside the material name changes to reflect the type .

***Note –** You must select the correct type, as this determines which options you see later in the setup process.*

6. Tap **Application Rates**:



Seed planting rates are measured in the following units:

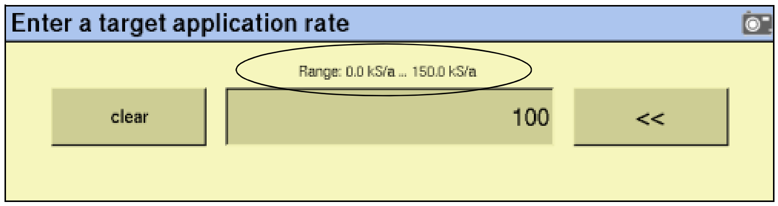
Unit	Symbol	Description
Metric	kg/ha kg/l (density)	Kilograms of fertilizer per hectare Kilograms of fertilizer per liter
US/Imperial	lb/a lb/ft^3 (density)	Pounds of fertilizer per acre Pounds of fertilizer per cubic foot

7. Enter the following values:

Item	Description
Minimum Rate	The minimum preset rate that the system will allow you to select.
Maximum Rate	The maximum preset rate that the system will allow you to select.
Increment/ Decrement	When you tap the **+** or **–** button on the Run screen channel tab, you increase or decrease the granular fertilizer target rate. The Increment/Decrement value is the percentage that the target rate changes by.
Density	The weight per volume of the material to dispense.
Low RPM Limit	The lowest shaft speed at which the control channel will operate.
High RPM Limit	The highest shaft speed at which the control channel will operate.
Spreader Constant	Each material has its own constant that is the number of application rate sensor pulses per liter (cubic ft) of material. Ensure that this is as accurate as possible. If you know the spreader constant, enter it, but using the Spreader Constant Calibration wizard is recommended. See Spreader constant, page 423.

The ***target rate*** is the rate at which the implement will distribute this material. You must add at least one target rate before you can exit this screen.

8. To add a target rate:
   a. Tap **Add**. The *Enter a target application rate* screen appears.
   b. Tap **kg/ha** or **lbs/a**, as appropriate.
   c. Enter the new rate and then tap **OK**. The rate must be higher than the *Minimum Rate* and lower than the *Maximum Rate*. These limits are shown on the screen:



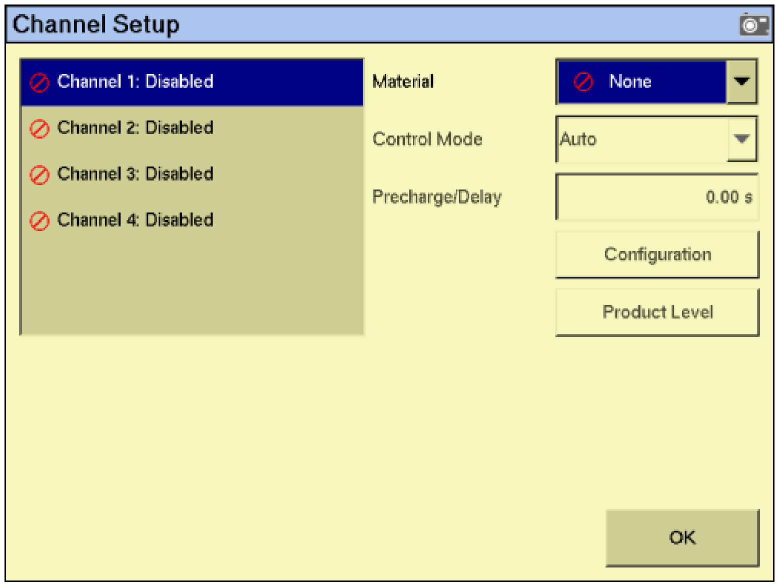
   d. Enter additional rates, if required. This enables you to switch between multiple rates on the Run screen. You can add up to eight preset target rates. If you create multiple rates, select the one that is to be the default rate and then tap **Set Default**.
9. Tap **OK**. The *Material Setup* screen reappears.
10. Tap **Alarms**. The *Alarms Setup* screen appears.
11. Enter the *Product Level Alarm* time. When the product drops to this level, a warning is triggered.
12. Tap **OK** and then tap **OK** again.

The material is now configured. Repeat this process to add an additional material.

Configuring the channels

Once you configure a material, you can configure the channels. The FM-1000 integrated display can control up to four channels of different materials at once.

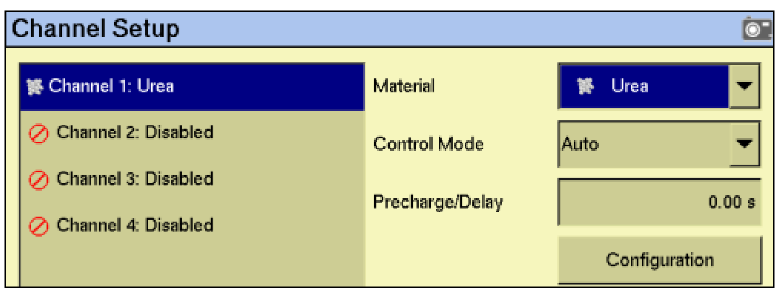
1. From the *4 Channel Setup* screen, tap **Channels**:



2. From the list on the left, select a channel to configure.

   The materials that you set up are available in the *Material* list.

3. From the list, select one of the materials:



4. Select the appropriate entry from the *Control Mode* list:

Item	Description
Auto	Control Channel calculates application rates under normal operating conditions.
Manual with Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease button on the Run screen, you adjust the Control Channel PWM% rate. The system shows the actual application rate being applied.
Manual w/out Feedback	Overrides the current system when not operating correctly. When you tap the Increase/Decrease buttons on the Run screen, you adjust the Control Channel PWM% rate. No application rate feedback is displayed.

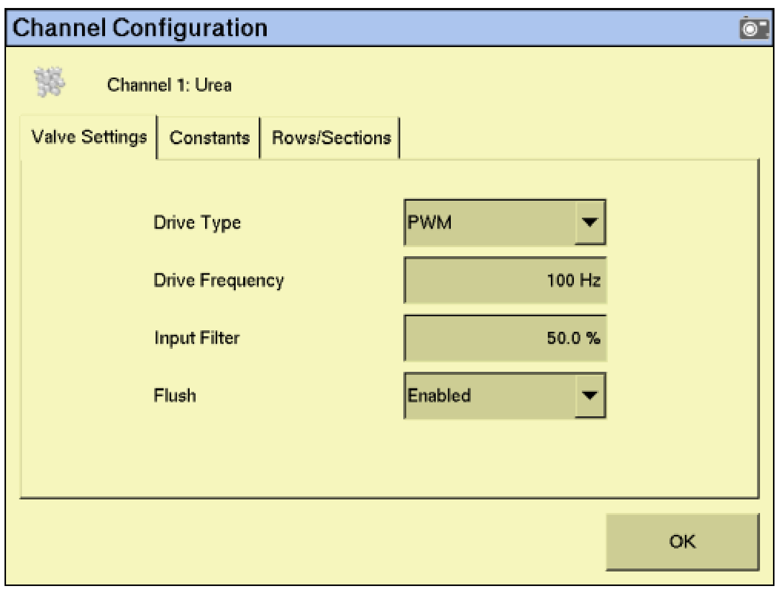
5. If necessary, change the *Precharge/Delay* setting.

The ***Precharge time*** is the length of time that a control channel will operate or be active when there is a minimum Precharge ground speed of greater than 1 (for precharge ground speed setup information, see Ground speed constant, page 416).

Typically, the Precharge feature is used in applications with a significant distance between the storage bulk fill tank and the implement row unit, where seed/fertilizer travel time takes several seconds. The feature operates until the Precharge time lapses or the Precharge ground speed is exceeded. If ground speed stops while in Precharge mode, the Precharge feature aborts. Any time the Preset feature is established or changed and the Master Switch is turned on, a Precharge alarm appears.

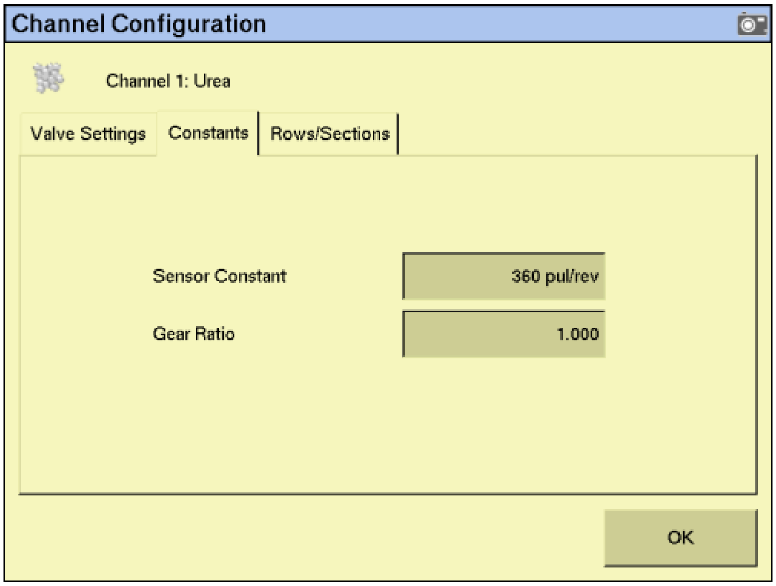
After you turn on the master switch and lower the implement, the system waits for the ***delay time*** before the control channel starts operating. When you raise the implement or turn on the master switch, the system immediately shuts down the channel.

6. Tap **Configuration**. Configure the appropriate Valve Settings:



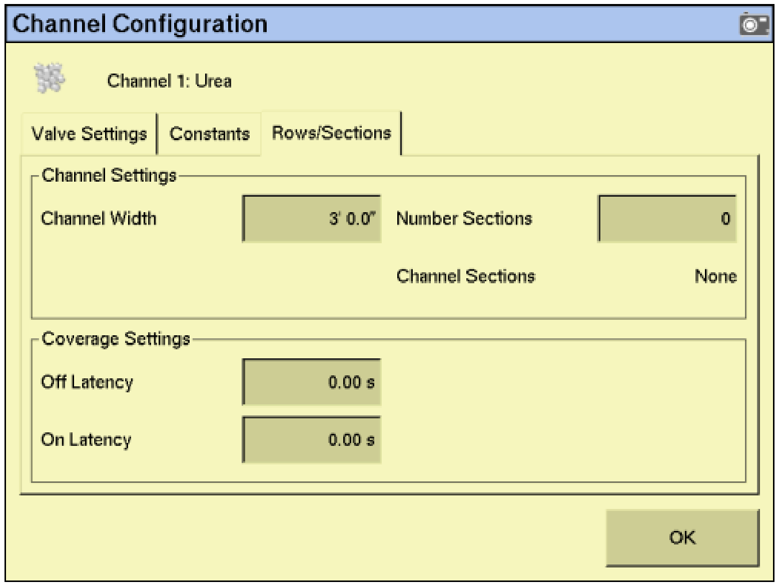
Item	**Description**
Drive Type	Select the granular fertilizer drive type: • PWM – (Pulse Width Modulation) A proportional valve that varies the oil flow to a hydraulic motor based on the electric current supplied. This type of valve consists of a flow cartridge and coil assembly. • Servo – A ball valve or butterfly valve driven by an electric motor gearbox and installed in the main product delivery line.
Drive Frequency	The frequency of the drive. This information is supplied by the drive manufacturer.
Input Filter	The amount of filtering that is applied to the flow meter feedback. If you adjust this setting, you must calibrate the drive.
Flush	

7. Configure the appropriate *Constants* settings:



Item	Description
Sensor Constant	The number of pulses per revolution of the sensor. For DICKEY-john application rate sensors, set the value to 360.0.
Gear Ratio	The ratio of the number of turns of application rate sensor to each turn of the granular fertilizer metering shaft.

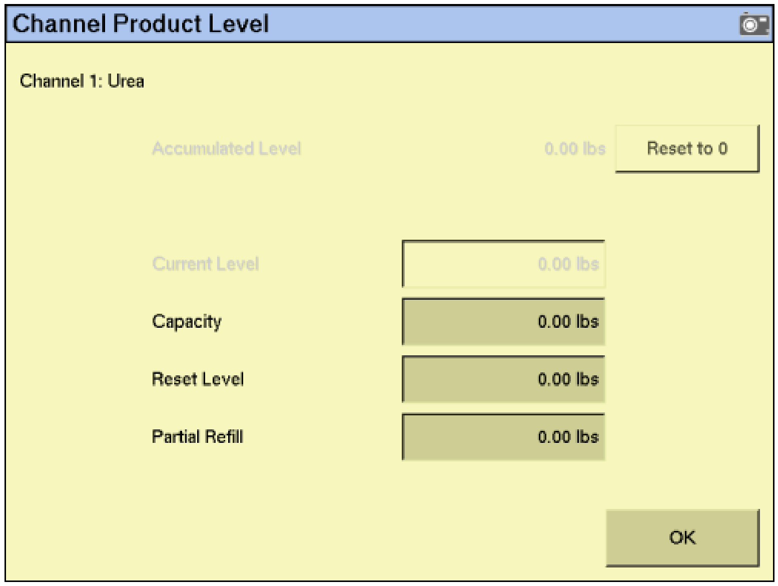
8. Configure the appropriate *Rows/Sections* settings:



Item	Description
Channel Width	The width of fertilizer applied for this channel.
Number Sections	Enables entry of a specific number of sections to the control channel. Section assignment is given priority based on the section and is assigned sequentially thereafter.
Off Latency	Measured in seconds and is the time it takes for the control channel to go from a running state to a stopped state. Enter a time here for the TAC system to automatically turn the channel off earlier to ensure that the system is off at the proper location when entering a covered area.
On Latency	Measured in seconds and is the time it takes for the control channel to go from a stopped state to a running state. Enter a time here for the TAC system to automatically turn the channel on earlier using the on latency value to ensure that the system is at operating speed when entering an uncovered area.

9. Tap **OK**. The *Channel Setup* screen reappears.

10. Tap **Product Level**:



In this screen, you set the *Capacity*, *Reset Level*, and *Partial Refill* values, so that you can quickly adjust the fertilizer weight in the field.

Note *– You set the Current Level and Accumulated Level from the Run screen.*

11. Tap the *Capacity* field and then enter the weight of fertilizer (in kilograms or pounds) that the planter/spreader holds when full.
12. Tap the *Reset Level* field and then enter the weight of fertilizer (in kilograms or pounds) that the planter/spreader can be reset to, for example, if you only fill it to the halfway point. You must set the capacity for this setting to work.
13. Tap the *Partial Refill* field and then enter the weight of fertilizer (in kilograms or pounds) that you will add to the planter/spreader if you do a partial refill.
14. Tap **OK**. The *Channel Setup* screen reappears.
15. If necessary, repeat this process for Channels 2, 3, and 4.

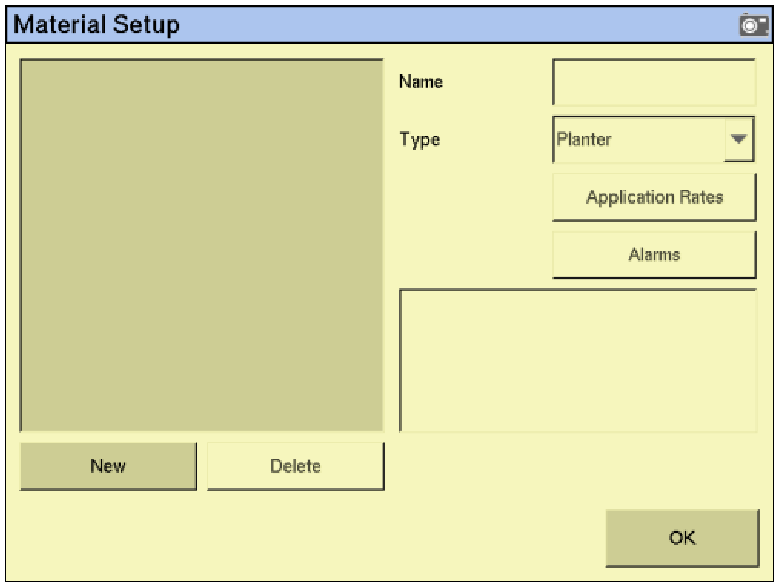
Once you assign the materials to channels, see Combining channels, page 415.

Configuring anhydrous

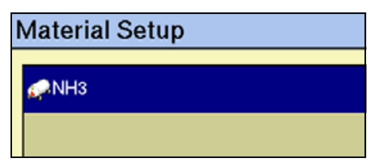
Entering materials

Enter the material to be applied:

1. From the *4 Channel Setup* screen, tap **Materials**:



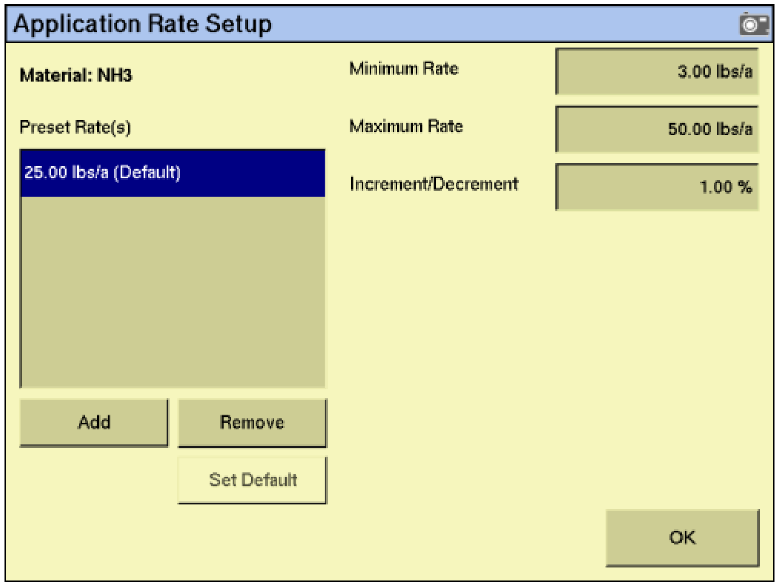
2. Tap **New**. The *Enter material name* screen appears.
3. Tap **CLEAR** and then enter a name that describes the material.
4. Tap **OK**. The *Material Setup* screen reappears with the new material in the list on the left of the screen.



5. In the *Type* list on the right of the screen, set the type of material to Anhydrous. The icon beside the material name changes to reflect the type .

***Note –** You must select the correct type, as this determines which options you see later in the setup process.*

6. Tap **Application Rates**:



Seed planting rates are measured in the following units:

Unit	Symbol	Description
Metric	kg/ha	Kilograms of nitrogen per hectare
US/Imperial	lbs/a	Pounds of nitrogen per acre

7. Enter the following values:

Item	Description
Minimum Rate	The minimum preset rate that the system will allow you to select.
Maximum Rate	The maximum preset rate that the system will allow you to select.
Increment/ Decrement	When you tap the **+** or **–** button on the Run screen planter tab, you increase or decrease the planter target rate. The Increment/Decrement value is the percentage that the target rate changes by.

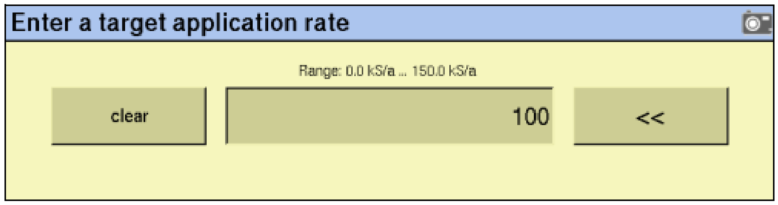
The ***target rate*** is the rate at which the implement will distribute this material. You must add at least one target rate before you can exit this screen.

8. To add a target rate:

a. Tap **Add**. The *Enter a target application rate* screen appears.

b. Tap **kg/ha** or **lbs/a**, as appropriate.

c. Enter the new rate and then tap **OK**. The rate must be higher than the *Minimum Rate* and lower than the *Maximum Rate*. These limits are shown on the screen:



d. Enter additional rates, if required. This enables you to switch between multiple rates on the Run screen. You can add up to eight preset target rates. If you create multiple rates, select the one that is to be the default rate and then tap **Set Default**.

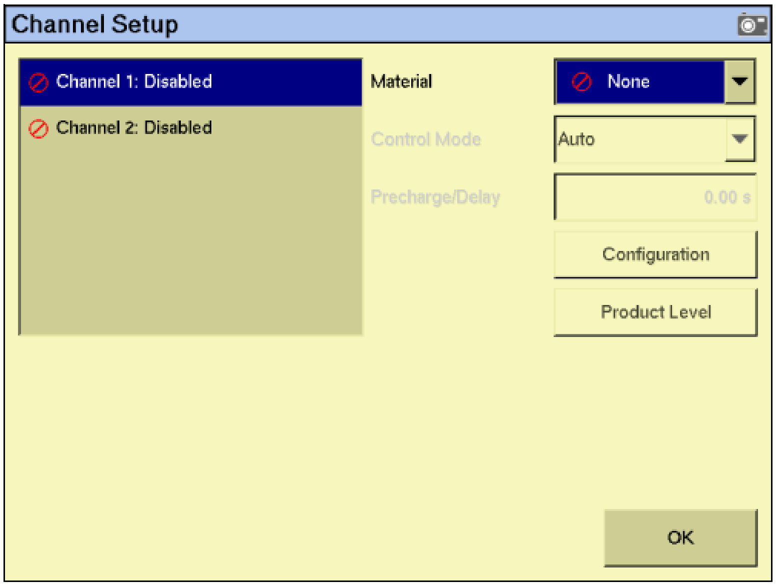
9. Tap **OK**. The *Material Setup* screen reappears.
10. Tap **Alarms**. The *Alarms Setup* screen appears.
11. Enter the *Product Level Alarm* weight. When the amount of product drops to this level, a warning is triggered.
12. Tap **OK** and then tap **OK** again.

The material is now configured. Repeat this process to add an additional material.

Configuring the channels

Once you configure a material, you can configure the channels. With anhydrous application, the FM-1000 integrated display can control up to two channels of material at once.

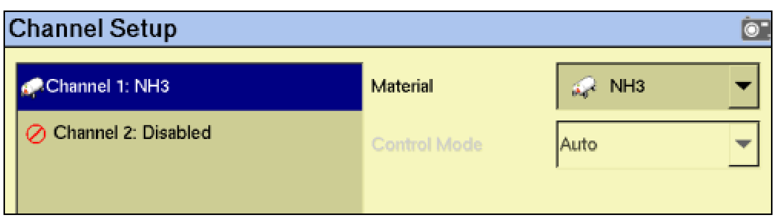
1. From the *4 Channel Setup* screen, tap **Channels**:



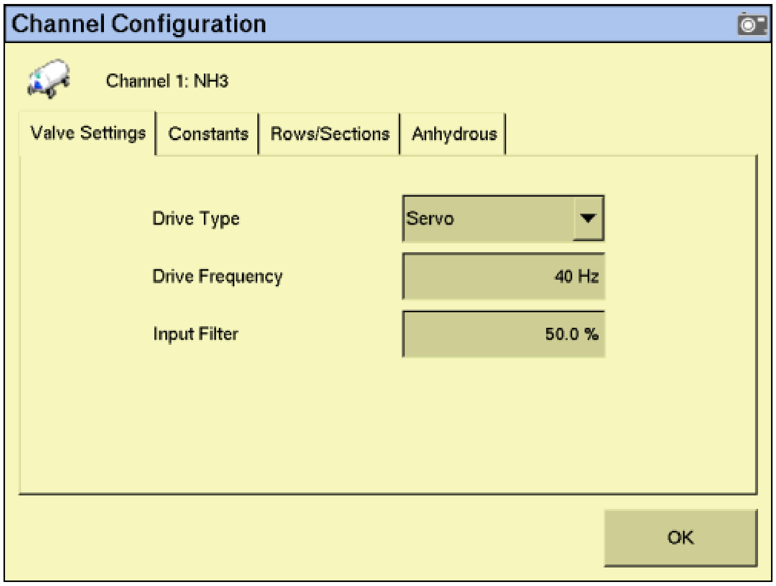
2. From the list on the left, select a channel to configure.

   The materials that you set up are available in the *Material* list.

3. From the list, select one of the materials:

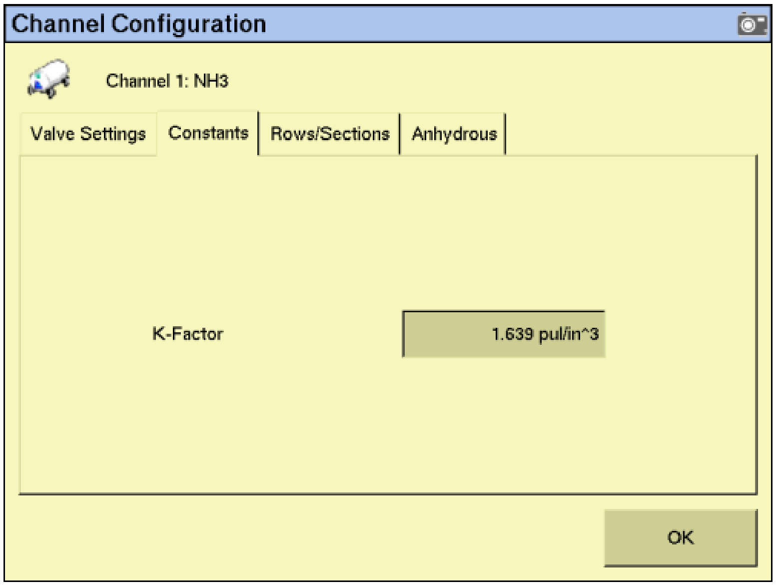


4. Tap **Configuration**. Configure the appropriate *Valve Settings*:



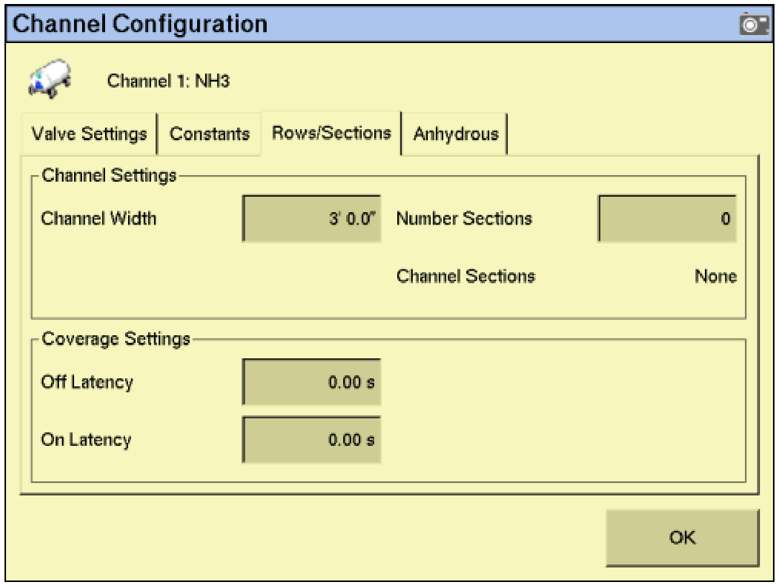
Item	Description
Drive Type	Servo – A ball valve or butterfly valve driven by an electric motor gearbox and installed in the main product delivery line.
Drive Frequency	The frequency of the drive. This information is supplied by the drive manufacturer.
Input Filter	The amount of filtering that is applied to the flow meter feedback. If you adjust this setting, you must calibrate the drive.

5. Configure the appropriate *Constants* settings:



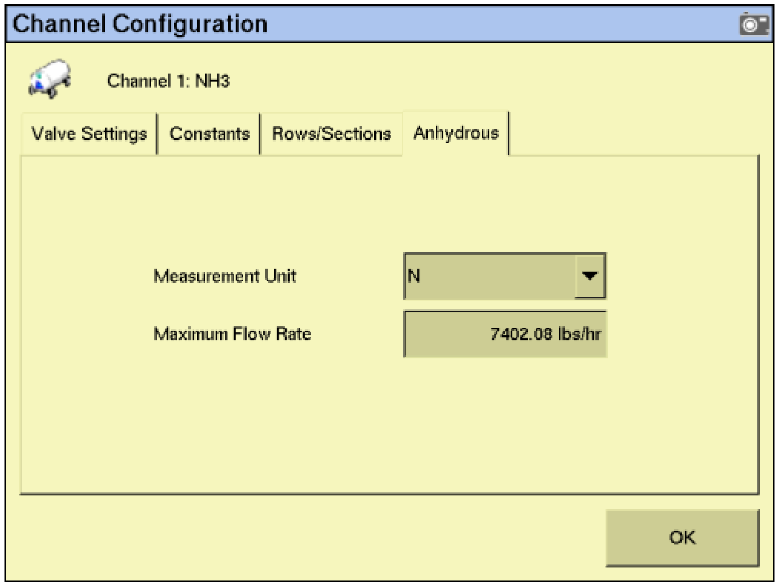
Item	Description
K-Factor	Every flowmeter has a K-Factor, which is the number of pulses per unit of measure. The K-Factor may be marked on the assembly. This K-Factor is a good starting point before doing a flowmeter calibration. In order to do an anhydrous flowmeter calibration, the system must be run in the field. With the K-Factor entered and accumulators cleared, record the weight of the nurse tank and proceed to apply nitrogen on at least ten acres at normal operating speeds and conditions. Verify that the control is stable during the calibration. Once the area is covered, record the tank weight. Calculate the amount of nitrogen used and compare that to the controller's accumulated values. Determine the percent of error and adjust the K-Factor accordingly. A typical DICKEY-john anhydrous flowmeter K-Factor starting point is 2.15 P/in^3. Fine-tuning the calibration: If the actual application is 5% above the *Target Application* rate, the K-Factor needs to be decreased by 5%. Therefore, if the K-Factor is 2.250, a 5% decrease would be 2.250 x 0.95 = 2.1375. The opposite applies for under application.

6. Configure the appropriate *Rows/Sections* settings:



Item	Description
Channel Width	The combined width assigned to this channel.
Number Sections	Enables entry of a specific number of sections to the control channel. Section assignment is given priority based on the section and is assigned sequentially thereafter.
Off Latency	Measured in seconds and is the time it takes for the control channel to go from a running state to a stopped state. Enter a time here for the TAC system to automatically turn the channel on later using the off latency value to ensure that the system is at operating speed when entering an uncovered area.
On Latency	Measured in seconds and is the time it takes for the control channel to go from a stopped state to a running state. Enter a time here for the TAC system to automatically turn the channel on later using the on latency value to ensure that the system is at operating speed when entering an uncovered area.

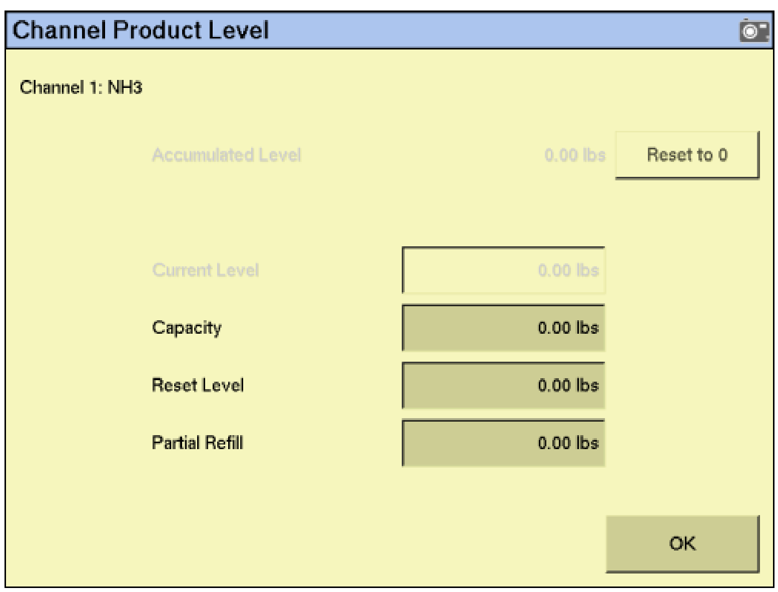
7. Configure the appropriate *Anhydrous* settings:



Item	Description
Measurement Unit	How the product is measured for the *Max Flow Rate* setting: N (nitrogen) or NH3 (anhydrous ammonia)
Max Flow Rate	When the nitrogen application reaches this flow rate, a warning appears.

8. Tap **OK**. The *Channel Setup* screen reappears.

9. Tap **Product Level**:



On this screen, you set the *Capacity*, *Reset Level*, and *Partial Refill* values, so that you can quickly adjust the weight in the field.

Note – *You set the Current Level and Accumulated Level from the Run screen.*

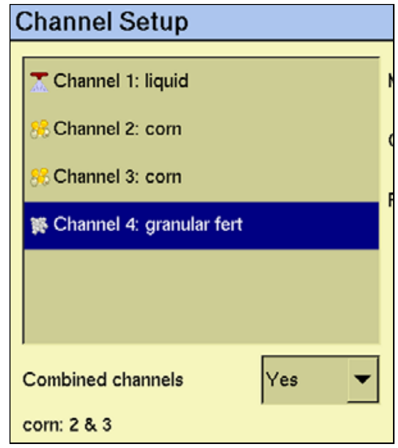
10. Tap the *Capacity* field and then enter the quantity (in kilograms or pounds) that the anhydrous tank holds when full.
11. Tap the *Reset Level* field and then enter the quantity (in kilograms or pounds) that the anhydrous unit can be reset to, for example, if you only fill it to the halfway point. You must set the capacity for this function to work.
12. Tap the *Partial Refill* field and then enter the quantity (in kilograms or pounds) that you will add to the anhydrous unit if you do a partial refill.
13. Tap **OK**. The *Channel Setup* screen reappears.
14. If necessary, repeat this process for Channels 2, 3, and 4.

Combining channels

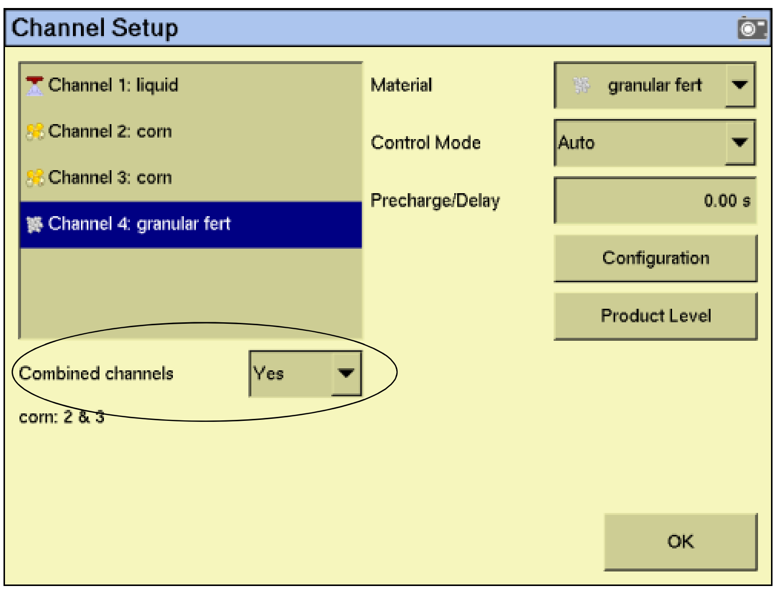
Once you assign all of the products, you can combine channels of the same product type that have the same name. This enables you to control multiple channels with one target rate.

If you have more than one product with the same name, the **Combine Channels** button appears on the *Channel Setup* screen.

In the example to the right, there are two channels of planter seed named “Corn”. You can combine the two channels that these seeds run through to use the same target rate.



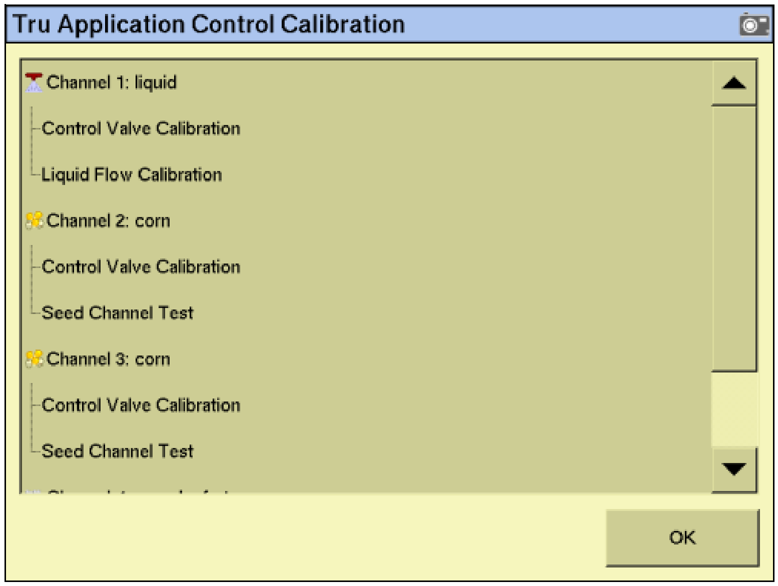
When you select *Yes* from the *Combine channels* drop-down list, the channels with the same names are combined:



Calibrating sensors

To calibrate the sensors:

1. Select the Tru Application Control plugin on the *Configuration* screen and then tap **Calibrate**:



2. Do the following:

To calibrate a...	See...
ground speed constant	page 416
control channel valve for a planter, granular seed, granular fertilizer, or liquid fertilizer	page 418
flow meter constant	page 421
control channel valve for anhydrous application	page 423
spreader constant	page 423
planter seed count	page 425

Once you calibrate the system, see Continuing, page 427.

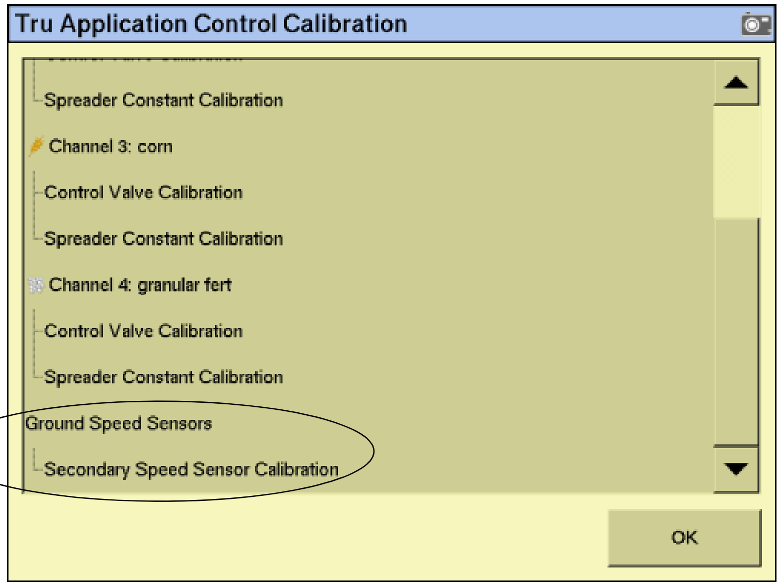
Ground speed constant

If you set either the primary ground speed sensor or the backup ground speed sensor to CAN Ground, Digital Sensor, or Reluctance Sensor, you must perform a calibration to determine the ground speed constant. To determine the constant, the system must count the number of pulses that the sensor produces while driving at a constant speed over:

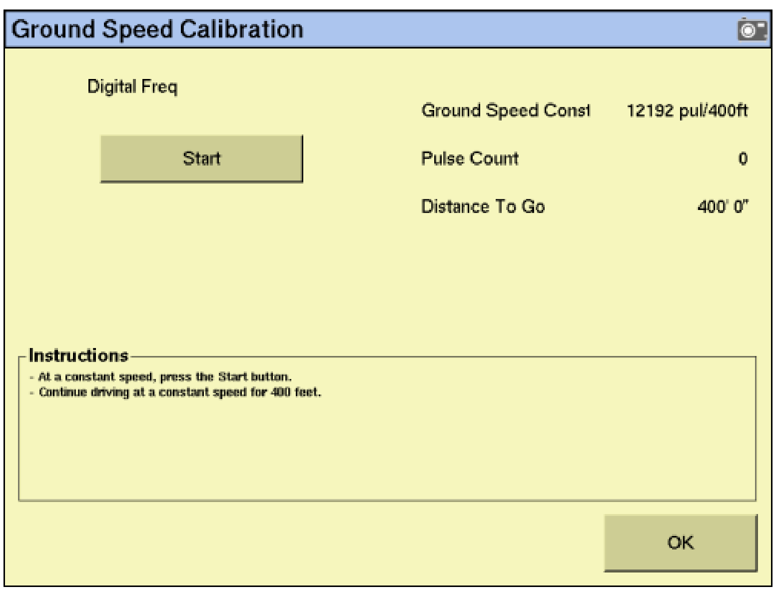
- a 400 ft distance when driving in US/Imperial mode
- a 100 m distance when driving in metric mode

To configure the sensor:

1. Position the vehicle where you can drive the required distance without stopping or changing speed.
2. From the *Tru Application Control Calibration* screen, select *Secondary Speed Sensor Calibration*:



The *Ground Speed Calibration* screen appears:



***Note** – This screen shows the values for a system using US/Imperial units.*

3. Begin to drive the vehicle at a constant speed (3.2–8 kph, or 2–5 mph).

4. When you are moving at a constant speed, tap **Start**:
   - The *Pulse Count* field increases.
   - The *Distance To Go* field reduces as you get closer to the end of the stretch.
5. Drive at the same speed until the *Distance To Go* field reads 0. The number of pulses counted appears in the *New Ground Spd Const* field.
6. To ensure accuracy, repeat step 3 through step 5 two more times
7. To save the new sensor constant, tap **Save**.
8. To leave the *Ground Speed Calibration* screen, tap **OK**. If you did not save the sensor constant that you calculated, it is not used.

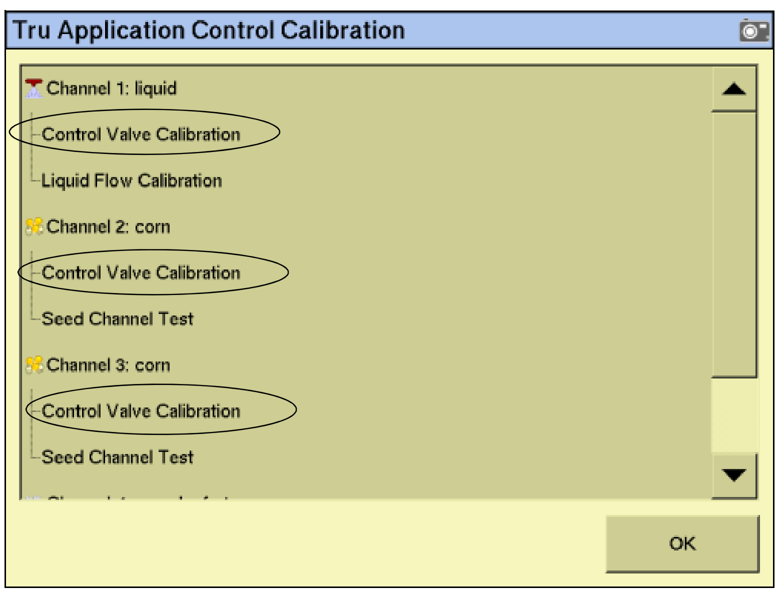
Control channel valve calibration: Planter, granular seed, granular fertilizer, or liquid fertilizer

The control channel valve calibration sets the vehicle hydraulic system parameters. Perform this calibration for each control channel that you set up.

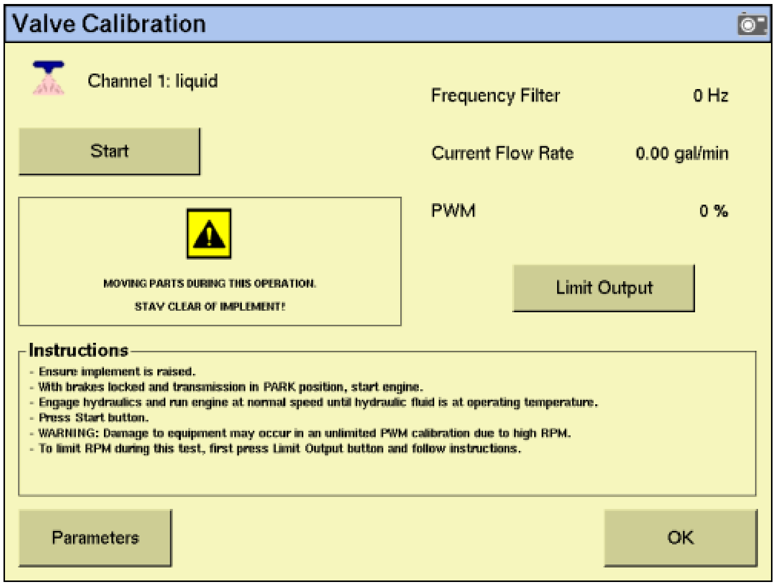
The hoppers can be empty for this calibration. If they contain material, it will fall on the ground.

To calibrate the valve:

1. From the *Tru Application Control Calibration* screen, tap the appropriate *Control Valve Calibration* item:



The *Valve Calibration* screen appears:



Note – *The* ***Limit Output*** *button does not appear for planters.*

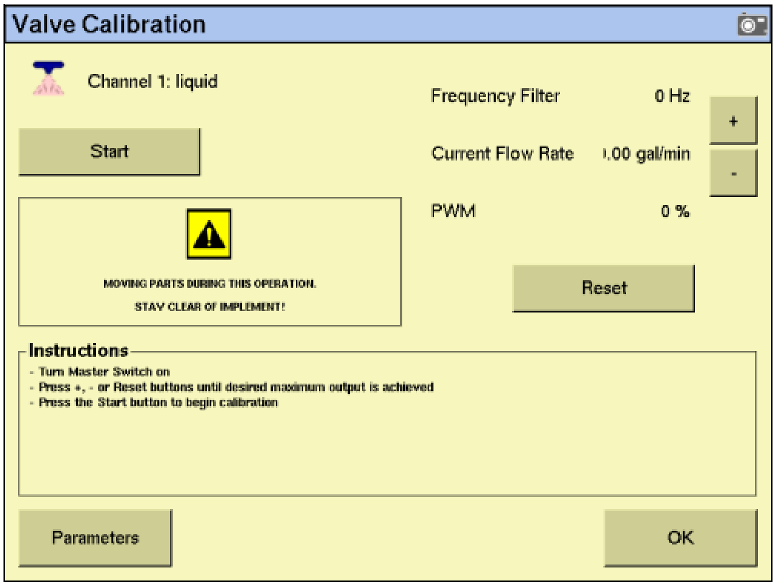
2. Raise the implement.
3. Apply the tractor brakes and lock them in the applied position.
4. Put the transmission in park or in a locked, neutral position.
5. Start the tractor and engage PTO if used to drive the hydraulic system.
6. Run the engine at normal operating speed until the hydraulic fluid is at normal operating temperature.

CAUTION – Do not adjust the calibration parameters unless instructed to do so by Technical Support.

7. Turn on the master switch.

8. If the material is granular seed, granular fertilizer, or liquid fertilizer and you want to limit the range of the PWM valve:

   a. Tap **Limit Output**. **+** and **–** buttons appear on the screen:

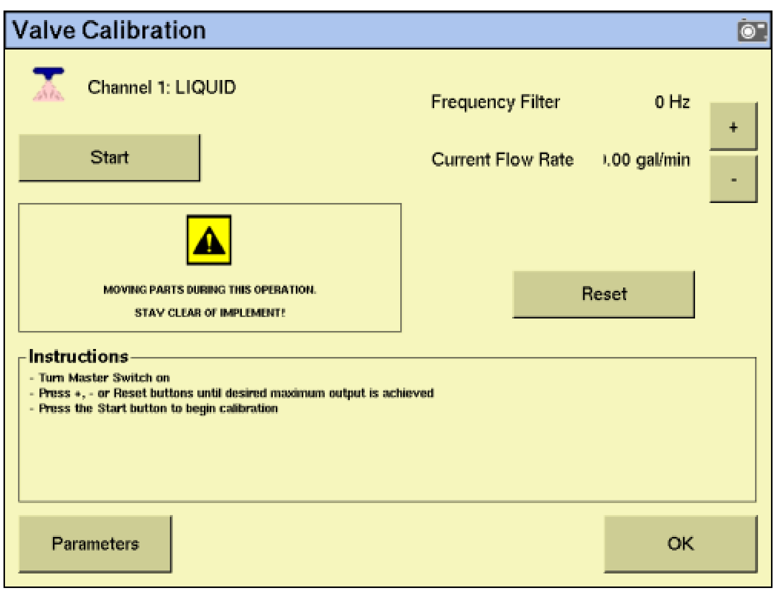


   b. tap **+** or **–** to adjust the limit of the valve.

WARNING – When you tap the control valve calibration **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

   c. When you find the maximum limit, tap **Start**:

   – If you used the Limit Output function, the calibration begins:



– If you did not use the Limit Output function, turn on the Master switch. The calibration begins.

The *PWM* value increases and then decreases. The calibration proceeds through several steps. When calibration is complete, the message Calibration complete appears in the *Instructions* window and the system turns off. The settings are automatically saved.

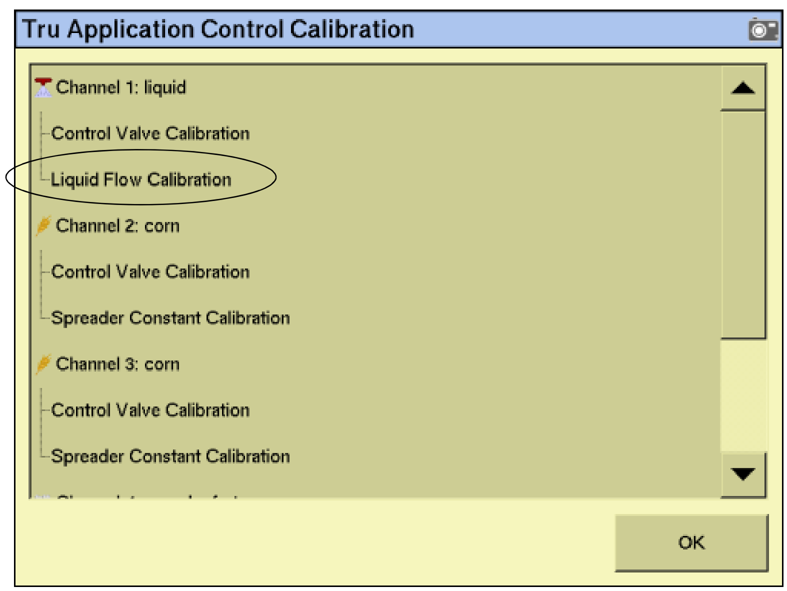
9. Tap **OK**.
10. Calibrate each of the valves on other channels.

Flow meter constant

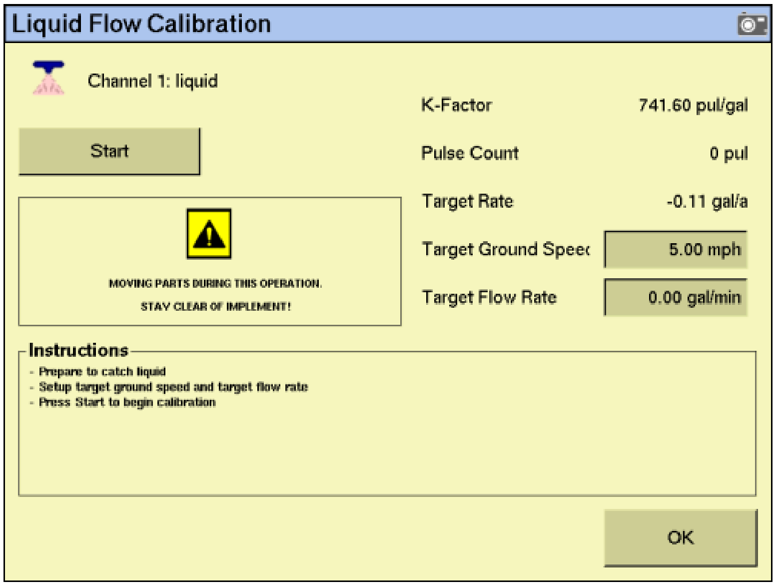
The flow meter constant is derived by finding the number of pulses of the flow meter that occur for a known quantity of liquid. This ratio of pulses to volume is called the ***K-Factor***.

To calibrate the sensor:

1. Put the vehicle transmission in park or in a locked, neutral position.
2. Run the engine at normal operating speed until the hydraulic fluid is at normal operating temperature.
3. From *Tru Application Control Calibration* screen, select *Liquid Flow Calibration*:



The *Liquid Flow Calibration* screen appears:



4. Adjust the *Target Ground Speed* or the *Target Flow Rate.*
   - The *Target Ground Speed* is the vehicle speed that the system will simulate.
   - The *Target Flow Rate* is the simulated application rate.

   The *Target Ground Speed* and *Target Flow Rate* are linked. If you adjust one, the other also adjusts because the faster the vehicle is traveling, the higher the flow rate must be to obtain the same level of application.

WARNING – When you tap the liquid flow calibration **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

5. Make sure that the tank contains liquid.
6. Place a container under the spray nozzles to catch the liquid output by the channel.
7. Tap **Start** and then turn on the master switch.
8. Allow the system to run for a while and then tap **Stop**. The longer that you run the system, the more accurate the result will be.
9. Measure the volume of liquid collected and then enter it into the *Amount Dispensed* window.
10. Tap **Continue**. The system calculates the *New K-Factor* value.
11. Tap **Save**. The new K-Factor is saved.
12. Tap **OK**.

Control channel valve calibration: Anhydrous

The anhydrous control channel valve calibration sets the vehicle hydraulic system parameters for anhydrous application.

1. From the *Tru Application Control Calibration* screen, tap the anhydrous entry. The *Valve Calibration* screen appears.

***Note** – The **Limit Output** button that was present for the other control channels does not appear for anhydrous.*

2. In the *Max Speed* window, enter the upper speed limit.
3. In the *Max App Rate* window, enter the maximum application rate.

CAUTION – Only adjust the calibration parameters if instructed to do so by Technical Support.

4. If necessary, adjust the calibration parameters:
   a. Tap **Parameters**. The *Edit calibration parameters* screen appears.
   b. Adjust any settings and then tap **OK**. The *Valve Calibration* screen reappears.

WARNING – The anhydrous valve calibration requires the vehicle and implement to be moving and the implement must be in the ground (the implement lift switch must be down). Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

5. Begin to drive the vehicle.
6. Tap **Start** and then turn on the master switch. The calibration begins. If the vehicle speed drops too low, or the vehicle stops moving, the calibration will abort.

   The value increases and then decreases. The calibration proceeds through several steps. When the calibration is complete, the message Calibration complete appears in the *Instructions* window and the system turns off. The settings are automatically saved.
7. Tap **OK**.

Spreader constant

***Note** – This is available only for granular seed and fertilizer applications.*

The spreader constant establishes the value for the amount of material dispensed through the application rate sensor. The value entered defines the pulses from the feedback sensor per ft^3 of material discharged. Each material (and gate setting as applicable) has its own spreader constant. For best results, the value must be as accurate as possible.

This value may be set manually. However, using the spreader constant calibration sequence is recommended for the most accurate results.

***Note** – This calibration requires scales to measure the amount of material collected.*

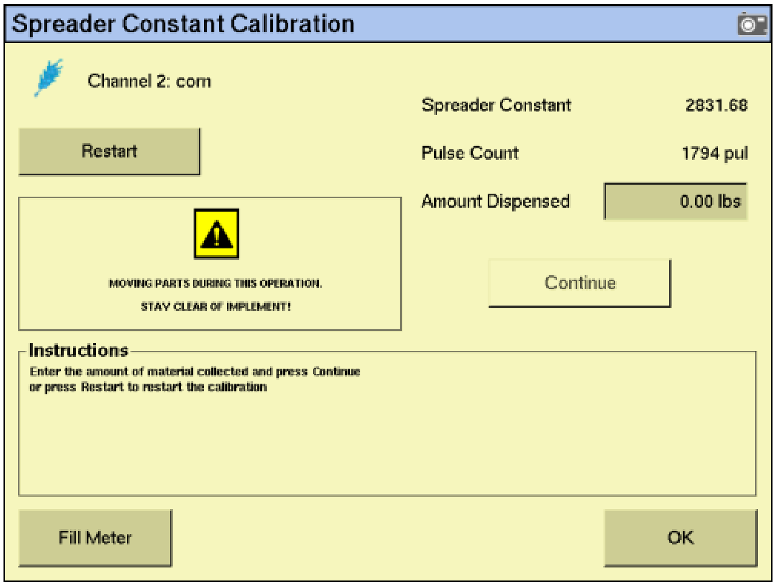
To calibrate the sensor:

1. Make sure that the hopper contains material.
2. Place a container under the spreader tubes to catch the output material.
3. Raise the implement.
4. Apply the tractor brakes and lock them in the applied position.
5. Put the transmission in park or in a locked, neutral position.
6. Start the tractor and engage PTO if used to drive the hydraulic system.
7. Run the engine at normal operating speed until the hydraulic fluid is at normal operating temperature.

WARNING – When you tap the fill disk **Output Shaft** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

8. Tap **Output Shaft** to rotate the shaft through one full rotation.
9. Adjust the *Target Meter RPM* value. This is the speed at which the seed meter shaft turns while the calibration is performed.
10. Adjust the *Number of Revs* value. This is the number of revolutions the meter will turn during the calibration. This constitutes the length of the test. The higher the number, the more accurate the calibration.
11. Tap **Start**.
12. Tap **Master** or turn on the external master switch in the cab. The calibration begins.

The system runs the dispensing unit (meter/conveyor) at the specified RPM for the specified number of meter revolutions and then automatically shuts down:

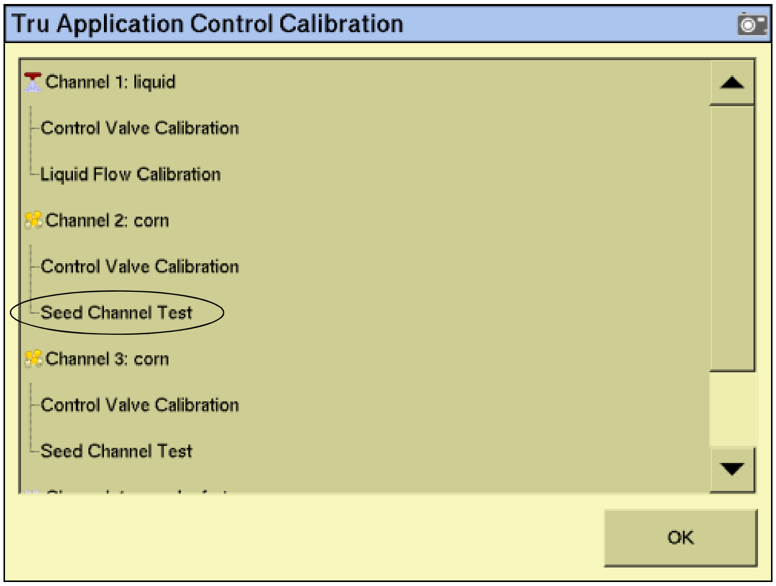


13. Weigh the material dispensed and then enter the value into the *Amount Dispensed* field. Remember to subtract the weight of the bucket or other receptacle.
14. Tap **Continue** and then tap **Save** to save the new spreader constant. Otherwise, tap **OK** to exit.

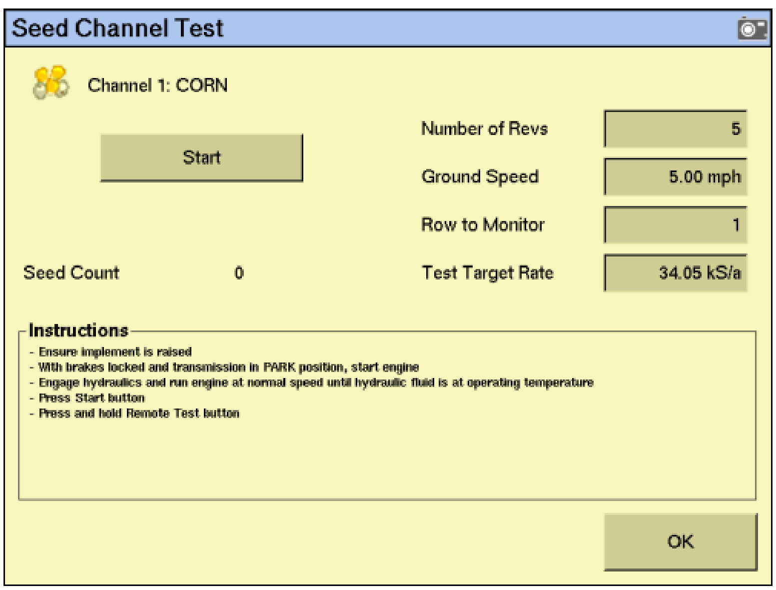
Planter seed count

This test uses the test switch. It enables you to run the system without lowering it. In this test, you run the planter for a known number of disk rotations and then count the seeds to ensure that they match the system's count.

1. From the *Tru Application Control Calibration* screen, select *Seed Channel Test*:



The *Seed Channel Test* screen appears:



2. Select the number of revolutions that you want the disk to turn through. The default is 5.
3. Select the ground speed that the system will simulate.
4. Select the row to monitor. You can select from the rows that are assigned to this channel, so the first row may not be 1.
5. Select the target planting rate.
6. Make sure that the hopper contains seed.

7. Place a container under the planter tube to catch the output material.
8. Tap **Start** and then tap the test switch. The disk turns and dispenses seed for the specified number of revolutions and then stops. The *Seed Count* value increases as the seed is dispensed.
9. Count the number of seeds collected to ensure that the quantity matches the *Seed Count* value.

Continuing

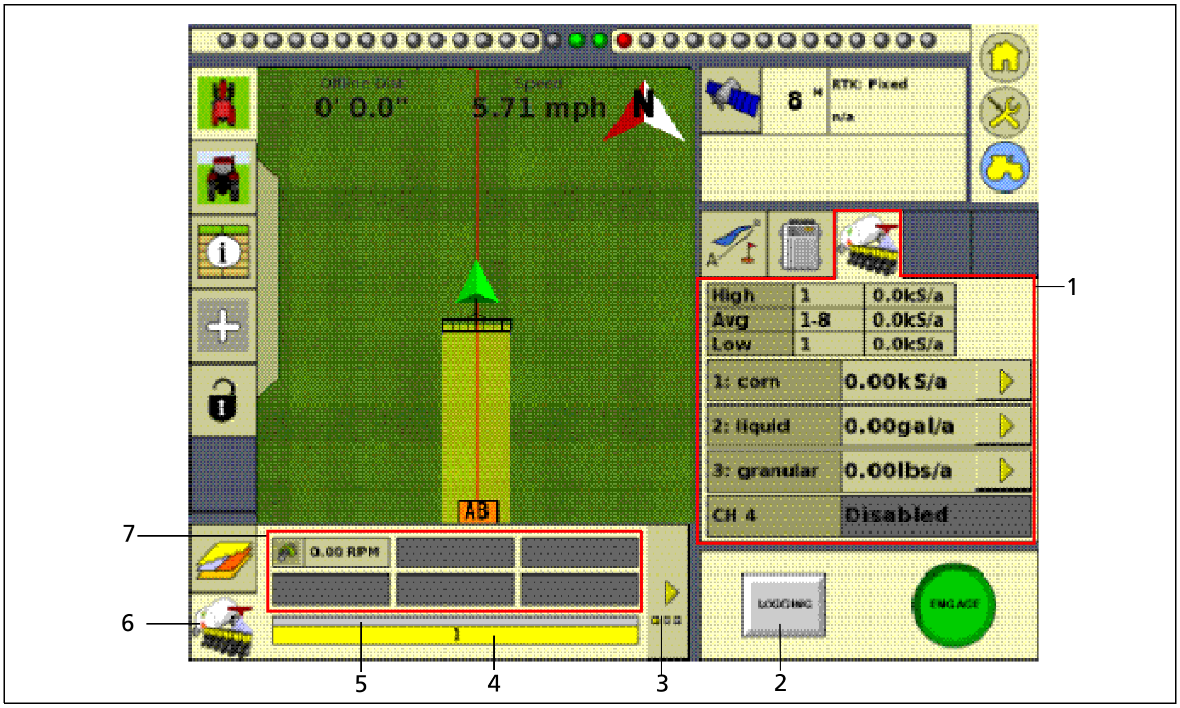
The sensors are now calibrated. Select one of the following:

To operate a…	See…
planter or drill	Operating a planter or drill, page 428
sprayer	Operating a sprayer (liquid flow), page 436
air seeder	Operating an air seeder (granular seed), page 440
spreader	Operating a spreader (granular fertilizer), page 448
anhydrous unit	Operating an anhydrous unit, page 453

Operating a planter or drill

WARNING – When the implement is down and the master switch is On, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

When you are controlling a planter or drill with the Tru Application Control plugin, several new items appear on the Run screen:



Item	Description
1	Planter tab
2	Logging on/off button
3	Planter row details button
4	Channel-to-row assignment bar
5	Row status bar
6	Row and sensor information tab
7	Additional sensor readings

Turning the planter on or off

Implement lift switch installed

If an implement lift switch is ***not*** installed, see page 430.

To plant seed when an optional implement lift switch is installed, you must engage both the ***master switch*** and the ***implement lift switch***.

When the master switch is engaged, the **Logging** button is engaged. When the implement lift switch is engaged so that the implement is down, the implement lift switch indicator changes as shown below:

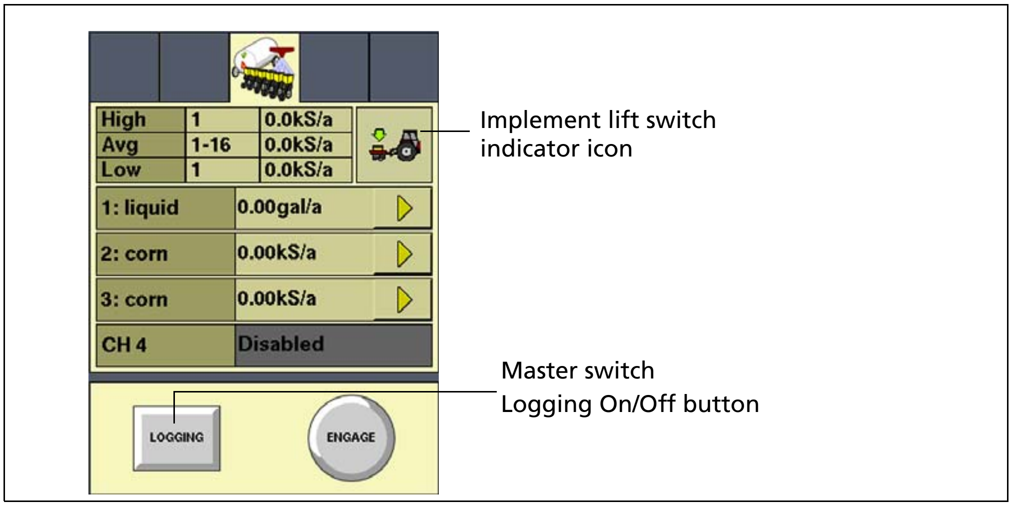
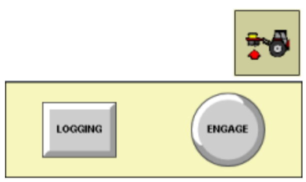
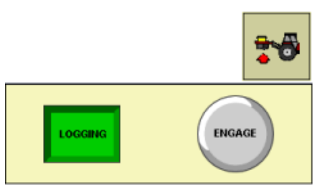
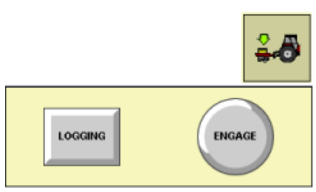
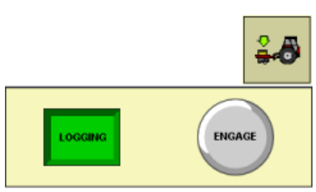


Illustration	Status	Description
	Implement switch is Off Master switch is Off	The implement is raised and the system is off.
	Implement switch is Off Master switch is On	The implement is raised. The master switch is turned on but logging does not occur because the planter is not applying seed.
	Implement switch is On Master switch is Off	The implement is lowered, but the system is off and therefore not planting seed (or logging coverage).
	Implement switch is On Master switch is On	The implement is lowered and the system is on and logging coverage.

Implement lift switch not installed

For the planter to plant seed, you must engage the ***master switch***.

When the master switch is engaged, the **Logging** button engages and the implement lowers. The **Logging** button and the position switch indicator change to show this:

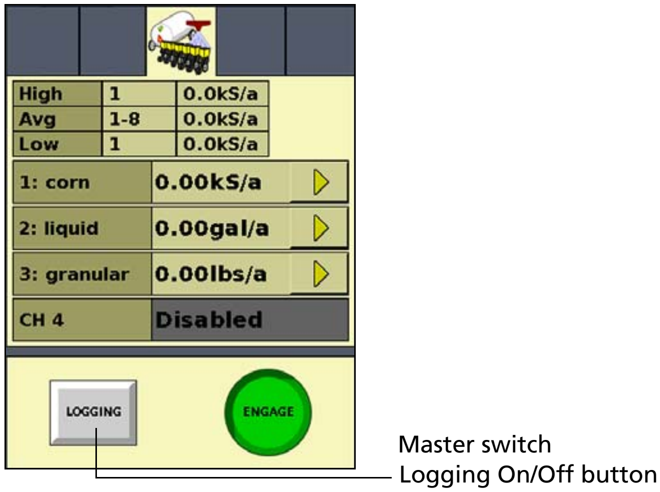
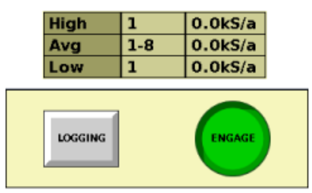
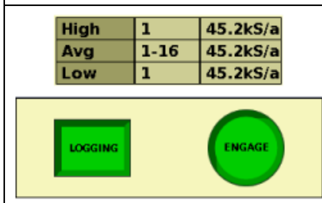
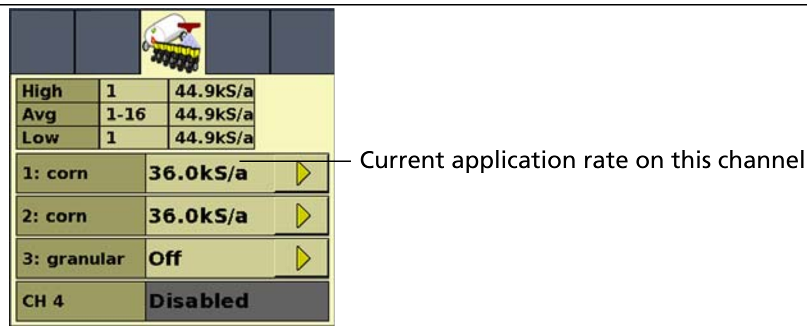


Illustration	Status	Description
	Master switch is Off	The implement is raised and the system is off.
	Master switch is On	The implement is lowered and the system is on and logging coverage.

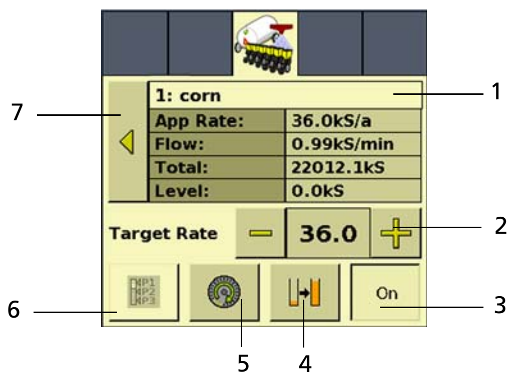
The planter channel (product) tab (overview mode)

The Tru Application Control plugin can control up to 4 products on a planter at once, enabling you to plant seed while spreading granular fertilizer, and/or spraying liquid. The planter tab on the right of the Run screen shows all the configured channels and their current status:



Detailed channel information button

To adjust the settings for an individual channel, tap the arrow  next to the channel. The tab shows the details of that channel:



Item	Description
1	• Channel name • Current application rate • Channel flow rate • Total applied so far • Tank level
2	Target rate (with Increase/Decrease buttons)
3	Channel on/off button
4	Quick link to the *Channel Product Level* screen. See page 379.
5	Fill disk button

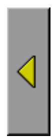
Item	Description
6	Preset target rate selection button: Select a different application rate from your preset entries. See page 370. ***Note –** This button is available only if you entered more than one target rate.*
7	Return button: Leave the detailed channel view and return to the overview.

Turning individual channels on or off

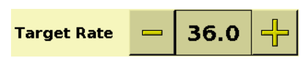
On the detailed channel tab, tap **On**. The channel is turned off when the **On** button is raised 

.

When you return to the channel status tab, the channel's current planting rate appears as Off. See Figure 11.1.

To return to the overview, tap .

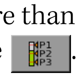
Adjusting the target rate (manually)



The Target Rate is the rate that you want the planter to plant at. To manually increase the target rate, tap **+**. To manually decrease the target rate, tap **–**.

The target rate adjusts by the Increment/Decrement value. See page 399.

Adjusting the target rate (with a preset rate)

If you created more than one preset rate for a material, the Preset Rate Selection button is available . Tap the button to select between the preset target rates.

The new preset rate appears between the **+** and **–** buttons.

Filling the planter disks before driving (Pre-prime button)

The planter has disks that rotate and drop seeds one-at-a-time. When the vehicle is moving, the seeds in the disk are continually replenished.

However, when you begin driving, the disks are empty. To avoid this, before you begin moving, tap the Fill Disk button .

This rotates the disks through one revolution to ensure that they are loaded with seed before you begin.

To fill the disks on this channel (and any channels combined with this one):

1. Tap the Fill Disk button. The *Fill Disk* screen appears.
2. Raise the implement.
3. Lock the vehicle brakes and put the vehicle in park.
4. Start the vehicle engine.

5. Run the vehicle until the hydraulic fluid is at operating temperature.

WARNING – When you tap the fill disk **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

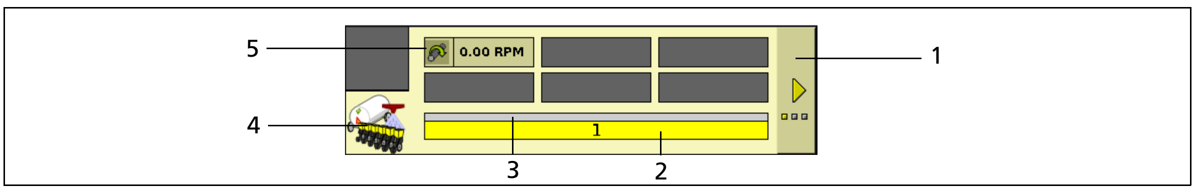
6. Tap **Start**.

The planter disks rotate and fill with seed. Repeat this process for any uncombined channels.

Row Information tab

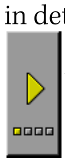
A planter can have up to 148 rows. Each row on the planter can have a sensor that reports the row's planting state.

The information that is reported by the sensors appears on the *Row Information* tab, which appears under the guidance screen:



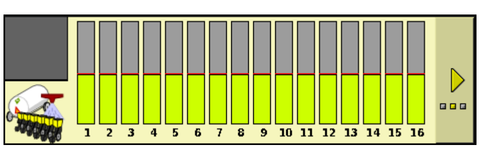
Item	Description
1	Show next screen (row details)
2	Channel-to-row assignment bar
3	Row status bar
4	Row Information tab selector
5	Additional sensor readings

The first screen of the tab shows a summary of all the rows, and any additional screens show the output of the rows in detail.

To view the next screen, tap .

Row details

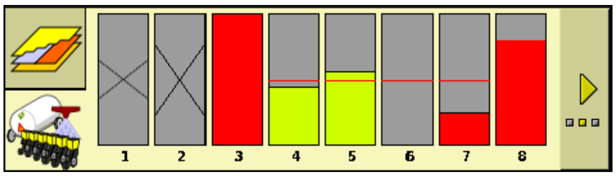
The row detail screens show the status of the rows in detail:



The row status is represented by its color:

Color	Description
Green	The row is operating within bounds
Red	The row is outside the acceptable bounds
A cross	The row is disabled

The onscreen width of the rows varies, depending on how many of them there are. In this example, the planter only has 9 rows:

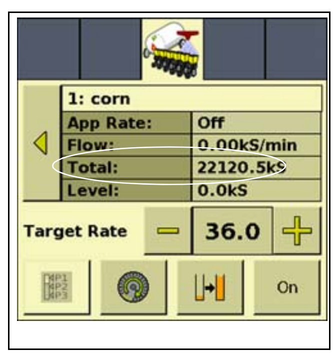


Row number	The row is...
1	off by clutch
2	off by channel
3	blocked (block sensor) or failed (population sensor)
4	operating (slightly below the target rate line)
5	operating (slightly above the target rate line)
6	passive (master switch is off)
7	operating (but below the acceptable bounds)
8	operating (but above the acceptable bounds)

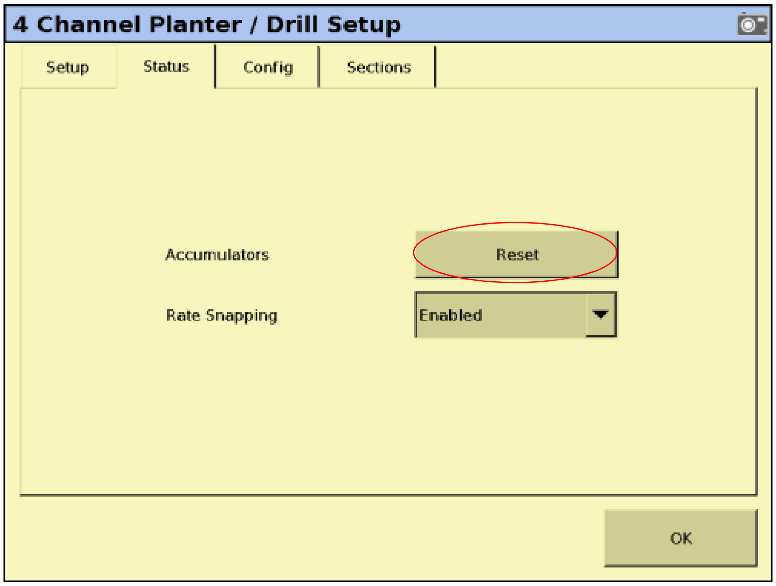
***Note** – Coverage is drawn even if an individual row is not operating (unless Tru Count Air Clutches are installed and switching is used).*

Material accumulator

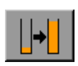
The ***material accumulator*** counts the amount of material that passes through each channel. The material accumulator value appears as the *Total* value on the Run screen.

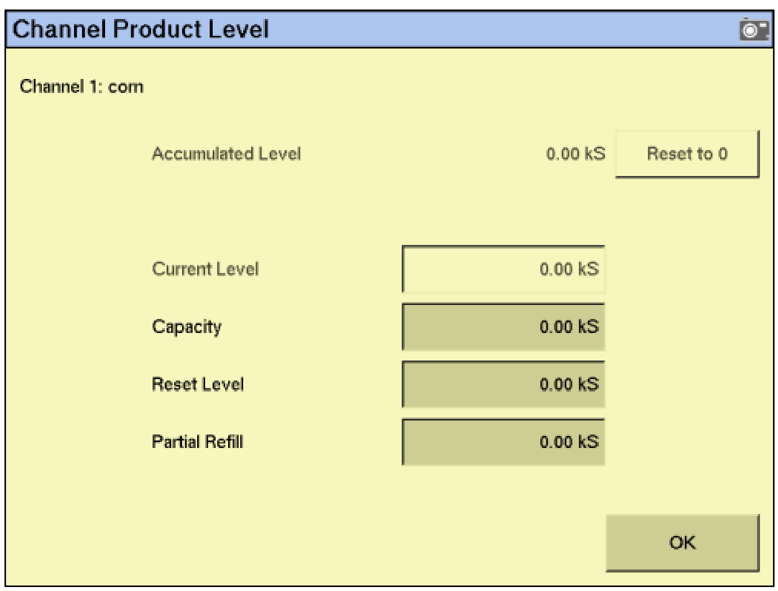


You can reset this value on the application setup screen or by selecting the *Channel Product Level* screen from the Run screen:



To access the *Channel Product Level* screen from the Run screen:

1. Show the details of one of the channels. See Detailed channel information button, page 431.
2. Tap the  button:

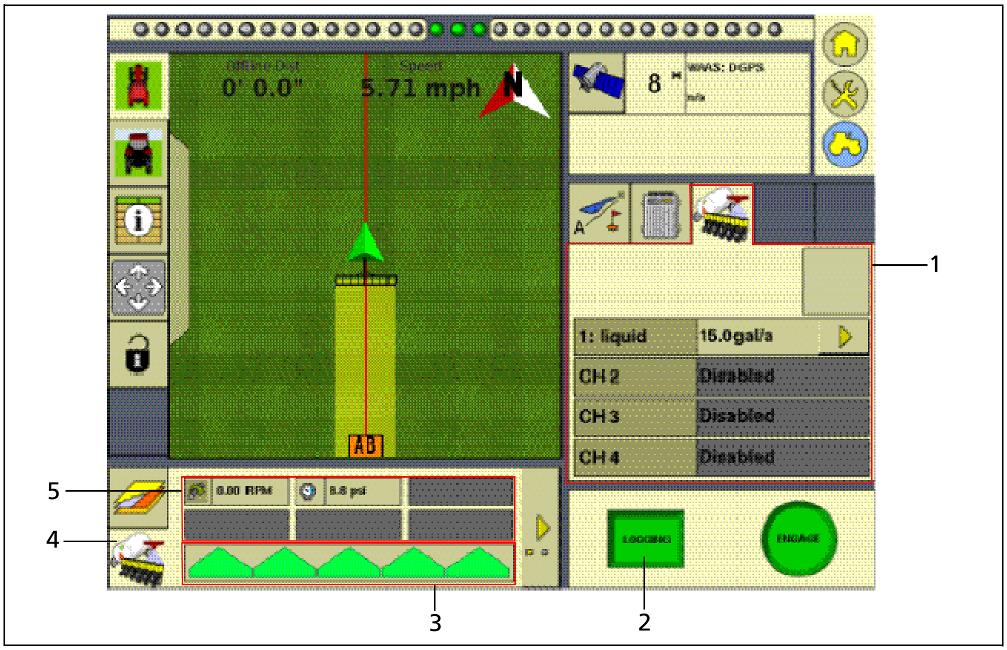


To reset the material accumulator and the tank level, tap **Reset to 0**.

Operating a sprayer (liquid flow)

WARNING – When the master switch is in the On position, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

When you are controlling a sprayer with the Tru Application Control plugin, several new items appear on the main guidance screen:

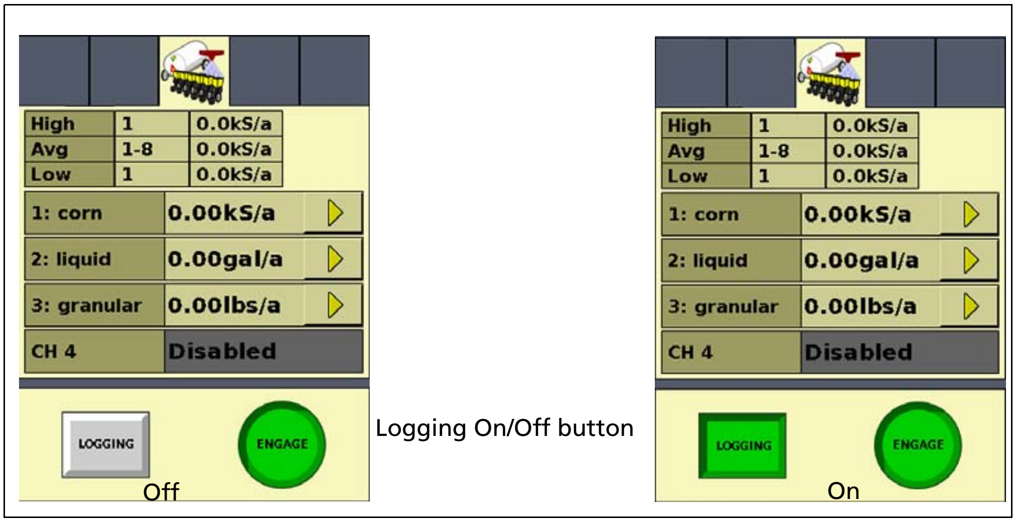


Item	Description
1	Sprayer tab
2	Logging on/off button
3	Sprayer bar
4	Sprayer section and sensors information tab
5	Additional sensor readings

Turning the sprayer on or off

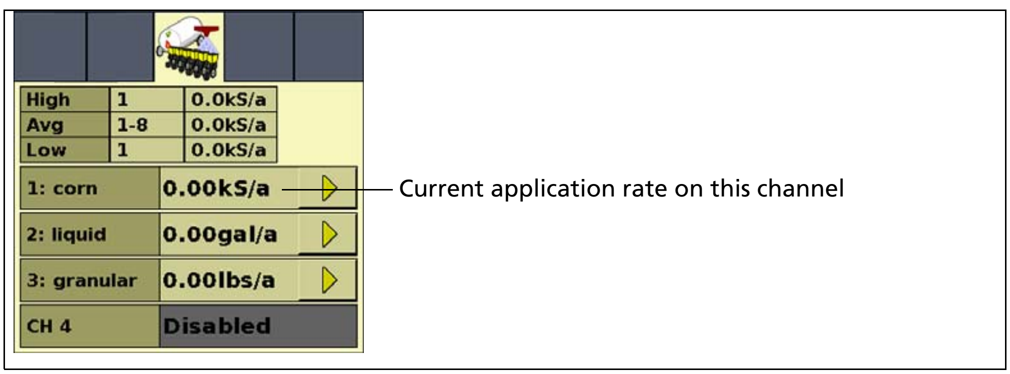
The master switch controls spraying. When you turn on the master switch, logging begins and the **Logging** button is engaged.

To turn off logging, tap **Logging**:



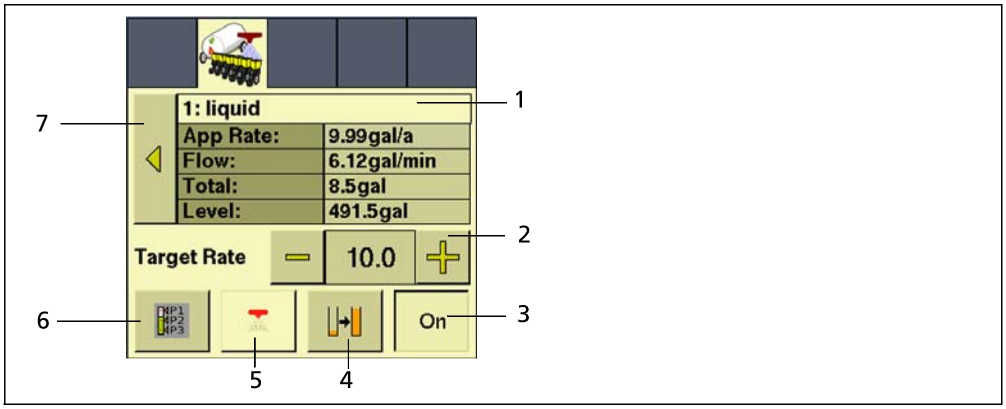
The Sprayer tab (overview mode)

The Tru Application Control plugin can control up to four liquid products on a sprayer at once. The sprayer tab on the right of the main guidance screen shows all of the configured channels and their current status:



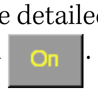
Detailed channel information button

To adjust the settings for an individual channel, tap the arrow  next to the channel. The tab shows the details of that channel:

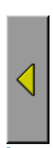


Item	Description
1	• Channel name • Current application rate • Channel flow rate • Total applied so far • Tank level
2	Target rate (with Increase/Decrease buttons)
3	Channel on/off button
4	Quick link to the *Channel Product Level* screen. See page 388.
5	Flush button (only available when Flush is enabled. See page 385 and page 439)
6	Preset target rate selection button: Select a different application rate from your preset entries. See page 380. ***Note –** This button is available only if you entered more than one target rate.*
7	Return button: Leave the detailed channel view and return to the overview.

Turning individual channels on or off

On the detailed channel tab, tap **On**. The channel is turned off when the **On** button is raised .

When you return to the channel status tab, the channel's current spraying rate appears as Off.

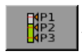
To return to the overview, tap .

Adjusting the target rate (manually)

The Target Rate is the rate that you want the sprayer to spray at. To manually increase the target rate, tap **+**. To manually decrease the target rate, tap **–**.

The target rate adjusts by the *Increment/Decrement* value. See page 381.

Adjusting the target rate (with a preset rate)

If you created more than one preset rate for a material, the Preset Rate Selection button is available 

. Tap the button to select between the preset target rates.

The new preset rate appears between the **+** and **–** buttons.

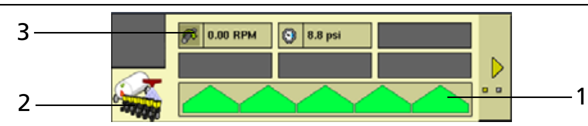
Flush mode

Flush is a manual override mode that opens the valve and dispenses material for a period of time for a defined flush speed. The Flush Enable feature can be activated only when the vehicle is stopped.

Section Information tab

A sprayer can have up to 24 sections. Each section is represented on the section layout bar.

The information that is reported by boom sections and additional sensors appears on the *Section Information* tab, which appears under the guidance screen:



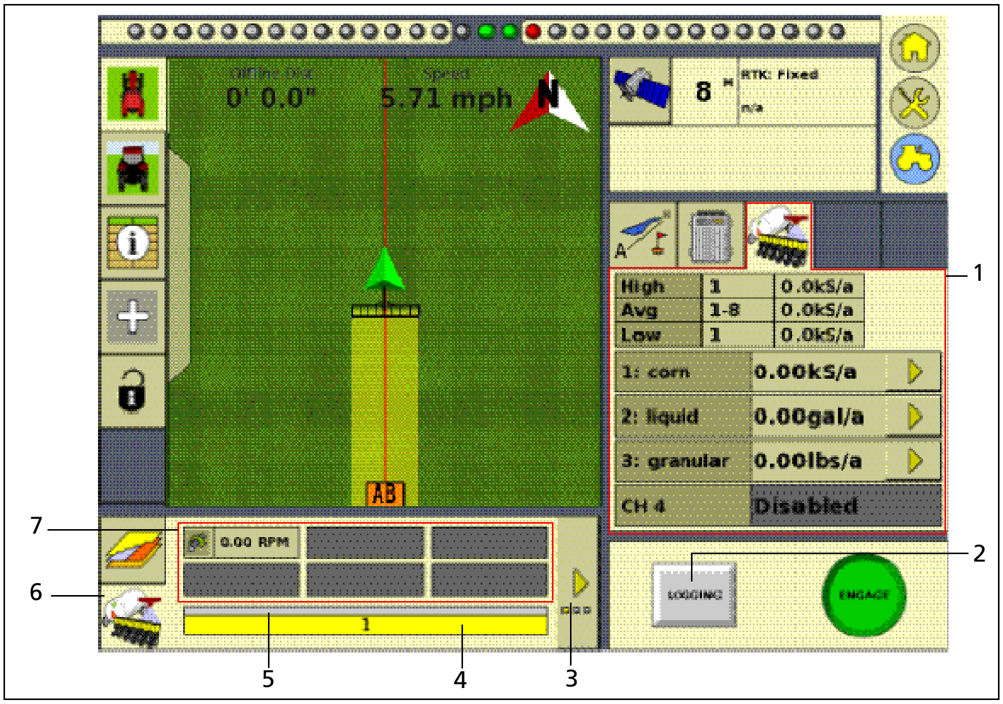
Item	Description
1	Section layout bar
2	Sprayer Information tab selector
3	Additional sensor readings

The first screen of the tab shows a summary of all the sections.

Operating an air seeder (granular seed)

WARNING – When the implement is down and the master switch is On, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

When you are running an air seeder with the Tru Application Control plugin, several new items appear on the main guidance screen:



Item	Description
1	Air seeder tab, see page 443
2	Logging on/off button
3	Air seeder row details button, see page 445
4	Channel-to-row assignment bar
5	Row status bar
6	Row Information tab
7	Additional sensor readings

Turning the air seeder on or off

Implement lift switch installed

If an implement lift switch is ***not*** installed, see page 442.

To apply seed if an optional implement lift switch is installed, you must engage both the ***master switch*** and the ***implement lift switch***.

When the master switch is engaged, the **Logging** button is engaged. When the implement lift switch is engaged so that the implement is down, the implement lift switch indicator changes as shown below:

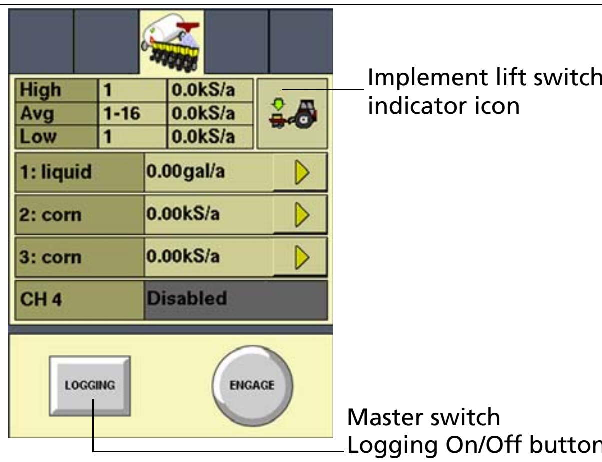
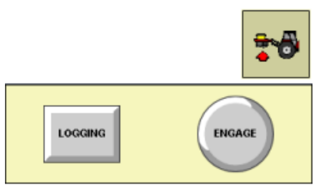
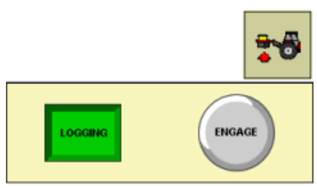
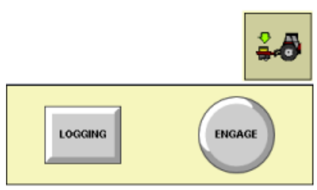
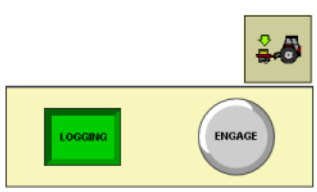


Illustration	Status	Description
	Implement switch is Off Master switch is Off	The implement is raised and the system is off.
	Implement switch is Off Master switch is On	The implement is raised. The master switch is turned on but logging does not occur because the air seeder is not applying seed.
	Implement switch is On Master switch is Off	The implement is lowered, but the system is off and therefore not applying seed (or logging coverage).
	Implement switch is On Master switch is On	The implement is lowered and the system is on and logging coverage.

Implement lift switch not installed

For the air seeder to apply seed, you must engage the ***master switch***.

When the master switch is engaged, the **Logging** button engages and the implement lowers. The **Logging** button and the position switch indicator change as shown below:

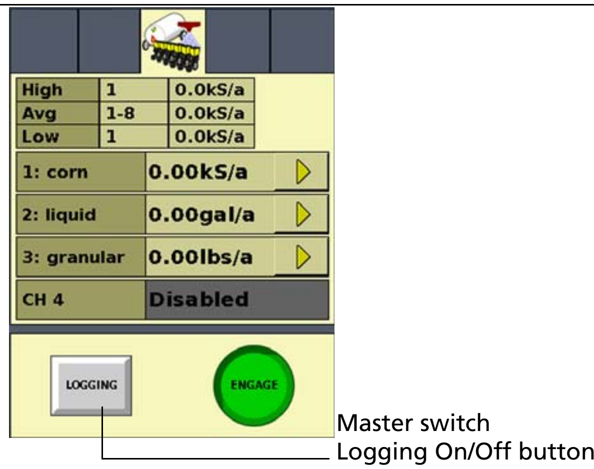
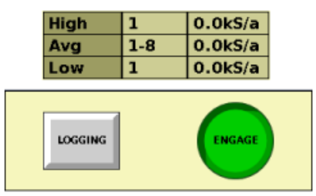
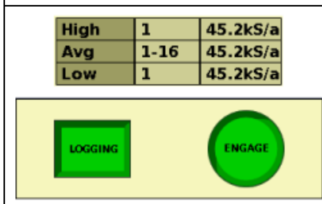
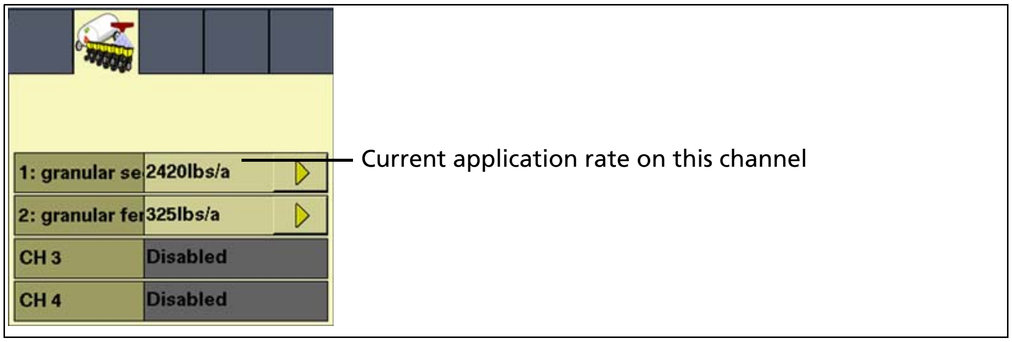


Illustration	Status	Description
	Master switch is Off	The implement is raised and the system is off
	Master switch is On	The implement is lowered and the system is on and logging coverage.

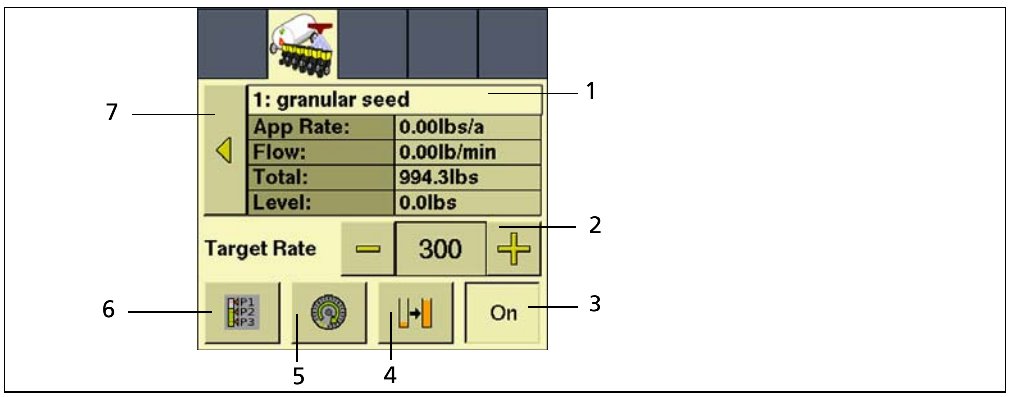
The air seeder product (channel) tab (overview mode)

The Tru Application Control plugin can control up to four products on an air seeder at once, enabling you to distribute seed while spreading granular fertilizer, spraying liquid, and/or applying anhydrous ammonia. The air seeder tab on the right of the main guidance screen shows all the configured channels and their current status:



Detailed channel information button

To adjust the settings for an individual channel, tap the arrow  next to the channel. The tab shows the details of that channel:



Item	Description
1	• Channel name • Current application rate • Channel flow rate • Total applied so far • Tank level
2	Target rate (with Increase/Decrease buttons)
3	Channel on/off button
4	Quick link to the *Channel Product Level* screen. See page 397.
5	Precharge button. This button changes to the Flush button  when you turn on the master switch. See page 439.

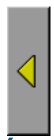
Item	Description
6	Preset target rate selection button: Select a different application rate from your preset entries. See page 389. ***Note –** This button is available only if you entered more than one target rate.*
7	Return button: Leave the detailed channel view and return to the overview.

Turning individual channels on or off

On the detailed channel tab, tap **On**. The channel is turned off when the **On** button is raised 

.

When you return to the channel status tab, the channel's current application rate appears as Off.

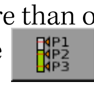
To return to the overview, tap .

Adjusting the target rate (manually)

The target rate is the rate that you want the air seeder to plant at. To manually increase the target rate, tap **+**. To manually decrease the target rate, tap **–**.

The target rate adjusts by the Increment/Decrement value. See page 390.

Adjusting the target rate (with a preset rate)

If you created more than one preset rate for a material, the Preset Rate Selection button is available 

. Tap the button to select between the preset target rates.

The new preset rate appears between the **+** and **–** buttons.

Precharging the air seeder before driving

When the vehicle is moving, the air seeder is continually distributing seed.

However, when you begin driving, the seed can take time to reach the tubes. To avoid this, tap Precharge  before you begin moving.

This ensures that seed distribution begins when you stat planting.

To precharge this channel (and any channels combined with this one):

1. Tap the Precharge button. The *Precharge* screen appears.
2. Raise the implement.
3. Lock the vehicle brakes and put the vehicle in park.
4. Start the vehicle engine.
5. Run the vehicle until the hydraulic fluid is at operating temperature.

WARNING – When you tap the fill disk **Start** button, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

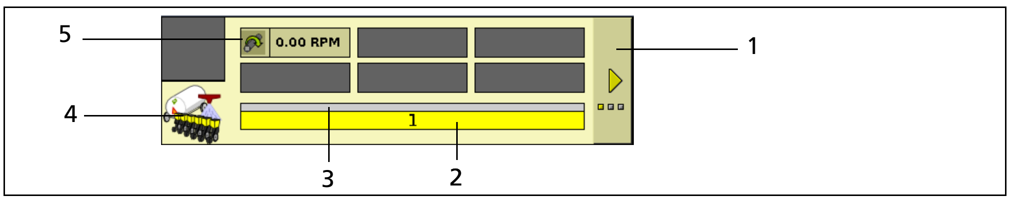
6. Tap the **Start** button.

The air seeder moves seed from the seeder bin. Repeat this process for any uncombined channels.

Row Information tab

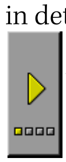
An air seeder can have up to 148 rows. Each row on the air seeder can have a sensor that reports the row's planting state.

The information that is reported by the sensors appears on the *Row Information* tab, which is under the guidance screen:



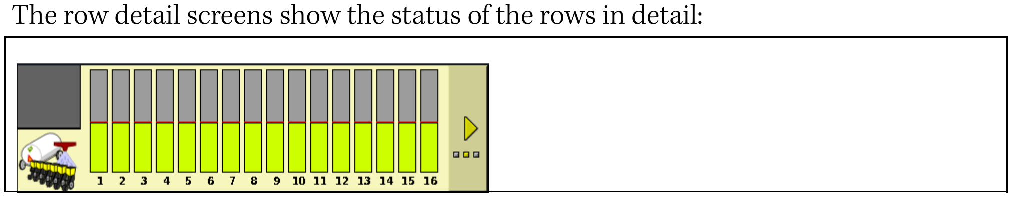
Item	Description
1	Show next screen (row details)
2	Channel-to-row assignment bar
3	Row status bar
4	Row Information tab selector
5	Additional sensor readings

The first screen of the tab shows a summary of all the rows, and any additional screens show the output of the rows in detail.

To view the next screen, tap .

Row details

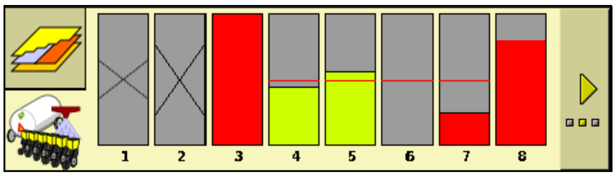
The row detail screens show the status of the rows in detail:



The row status is represented by its color:

Color	The row is...
Green	operating within bounds
Red	outside the acceptable bounds
A cross	disabled

The onscreen width of the rows varies, depending on how many of them there are. In this example, the planter only has 8 rows:



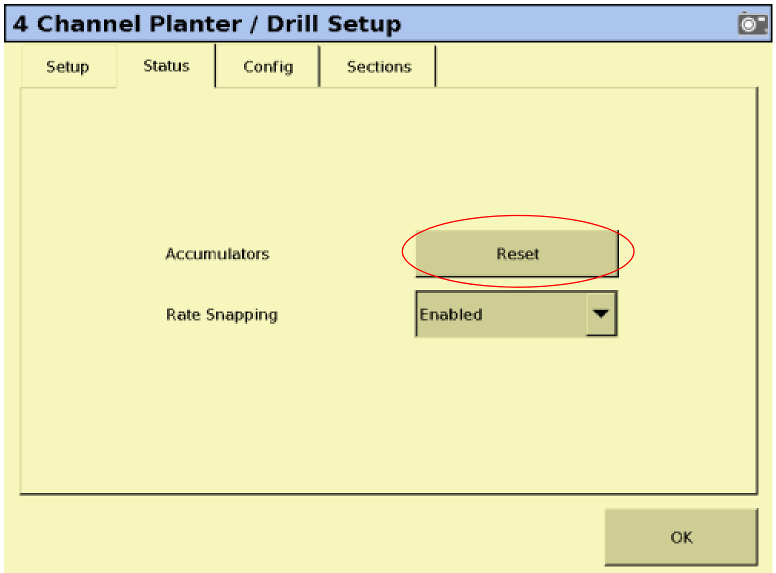
Row number	The row is...
1	operating (block sensor)
2	off by channel
3	blocked or failed
4	operating (slightly below the target rate line)
5	operating (slightly above the target rate line)
6	passive (master switch is off)
7	operating (but below the acceptable bounds)
8	operating (but above the acceptable bounds)

***Note** – Coverage is drawn even if an individual row is not operating.*

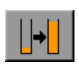
Material accumulator

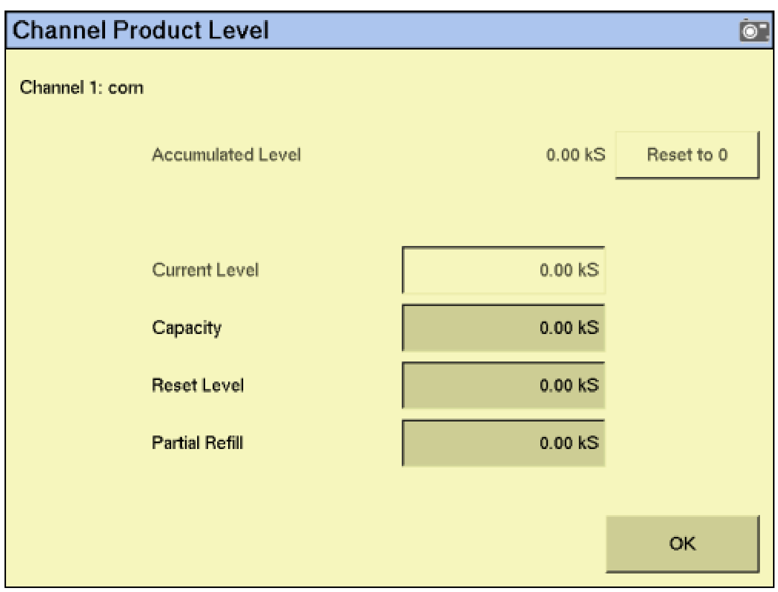
The ***material accumulator*** counts the amount of material that passes through each channel. The material accumulator value appears as the *Total* value on the main guidance screen.

You can reset this value on the application setup screen or by selecting the *Channel Product Level* screen from the main guidance screen:



To access the *Channel Product Level* screen from the main guidance screen:

1. Show the details of one of the channels. See Detailed channel information button, page 431.
2. Tap the  button:

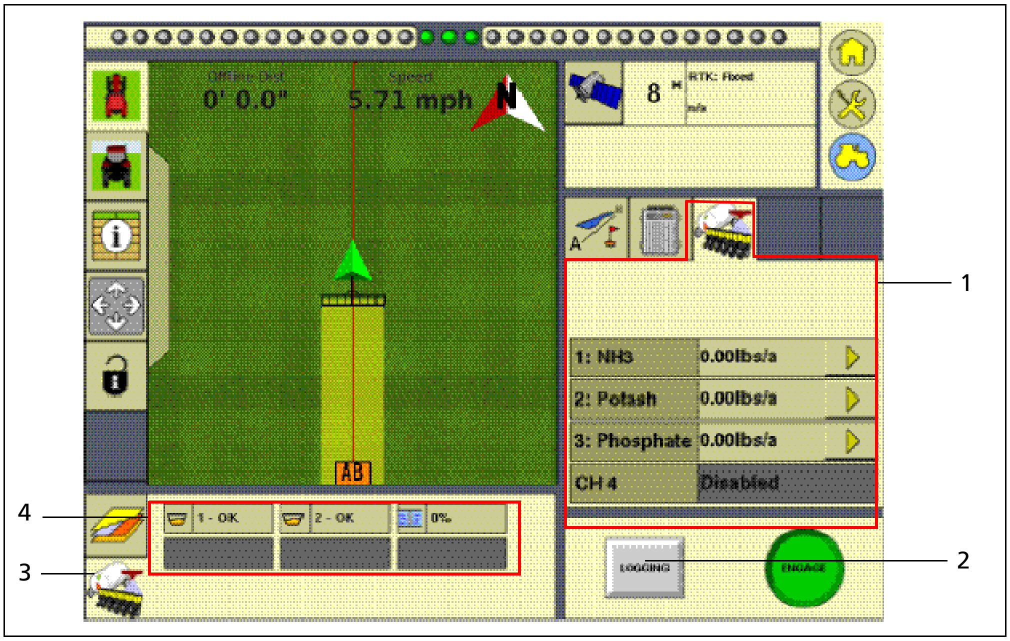


To reset the material accumulator and the air cart level, tap **Reset to 0**.

Operating a spreader (granular fertilizer)

WARNING – When the master switch is in the On position, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

When you are running a spreader with the Tru Application Control plugin, several new items appear on the main guidance screen:

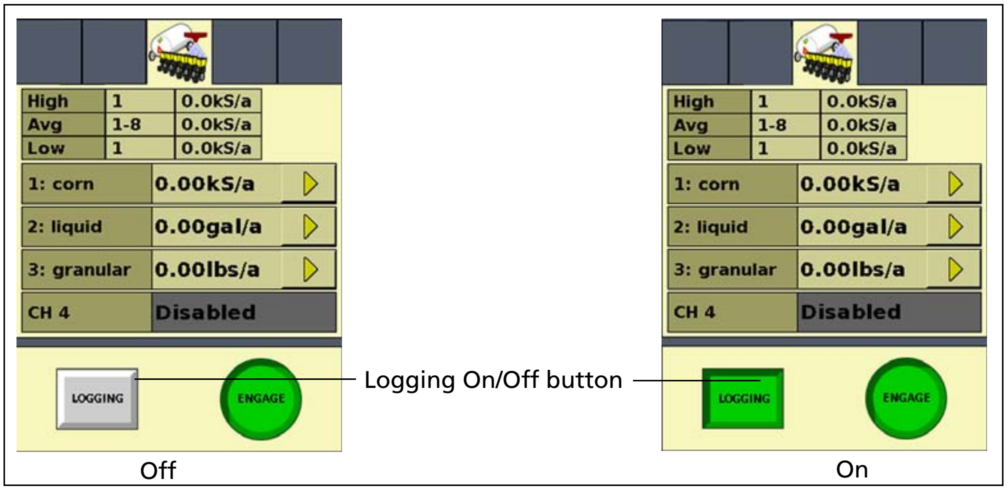


Item	Description
1	Spreader tab
2	Logging on/off button
3	Spreader Information tab
4	Additional sensor readings

Turning the spreader on or off

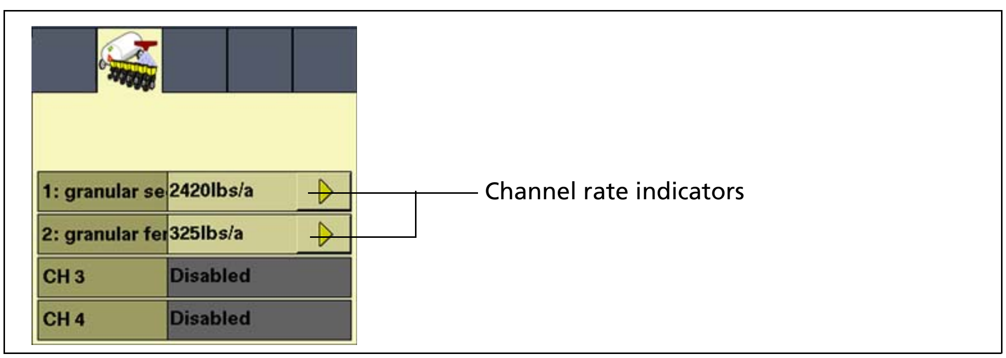
The Tru Application Control plugin is controlled by the master switch and the **LOGGING** button. When logging is engaged, the spreader application is on, and when logging is disengaged, the spreader application is off.

The tractor icon appears as shown below:



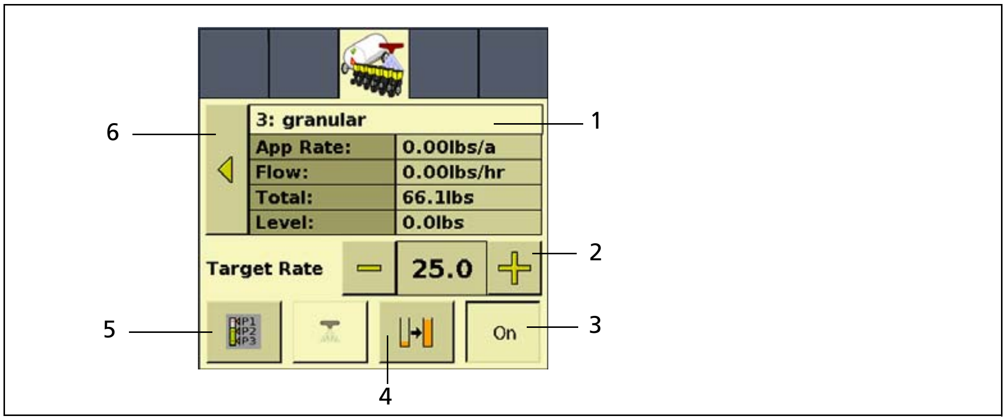
The Spreader product (channel) tab (overview mode)

The Tru Application Control plugin can control up to 4 products on a spreader at once. The spreader tab on the right of the main guidance screen shows all the configured channels and their current status:



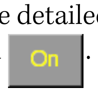
Detailed channel information button

To adjust the settings for an individual channel, tap the detailed channel information button  next to the channel. The tab shows the details of that channel:

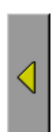


Item	Description
1	• Channel name • Current application rate • Channel flow rate • Total applied so far • Tank level
2	Target rate (with Increase/Decrease buttons)
3	Channel on/off button
4	Quick link to the *Channel Product Level* screen. See page 405.
5	Preset target rate selection button: Select a different application rate from your preset entries. See page 398. ***Note –*** *This button is available only if you entered more than one target rate.*
6	Return button: Leave the detailed channel view and return to the overview.

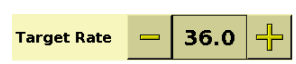
Turning individual channels on or off

On the detailed channel tab, tap **On**. The channel is turned off when the **On** button is raised .

When you return to the channel status tab, the channel's current planting rate appears as Off.

To return to the overview, tap .

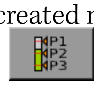
Adjusting the target rate (manually)



The Target Rate is the rate that you want the spreader to spread at. To manually increase the target rate, tap **+**. To manually decrease the target rate, tap **–**.

The target rate adjusts by the *Increment/Decrement* value. See page 399.

Adjusting the target rate (with a preset rate)

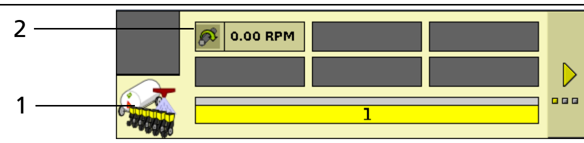
If you created more than one preset rate for a material, the Preset Rate Selection button  is available. Tap the button to select between the preset target rates.

The new preset rate appears between the **+** and **–** buttons.

Sensor Information tab

A spreader can be fitted with a hopper or an RPM sensor.

The information that is reported by the sensors appears on the *Row Information* tab, which is under the guidance screen:

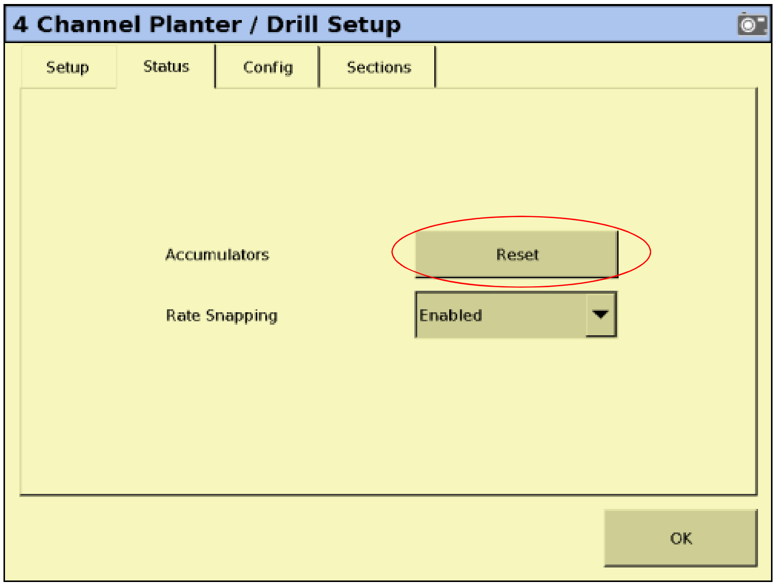


Item	Description
1	Row Information tab selector
2	Additional sensor readings

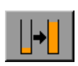
Material accumulator

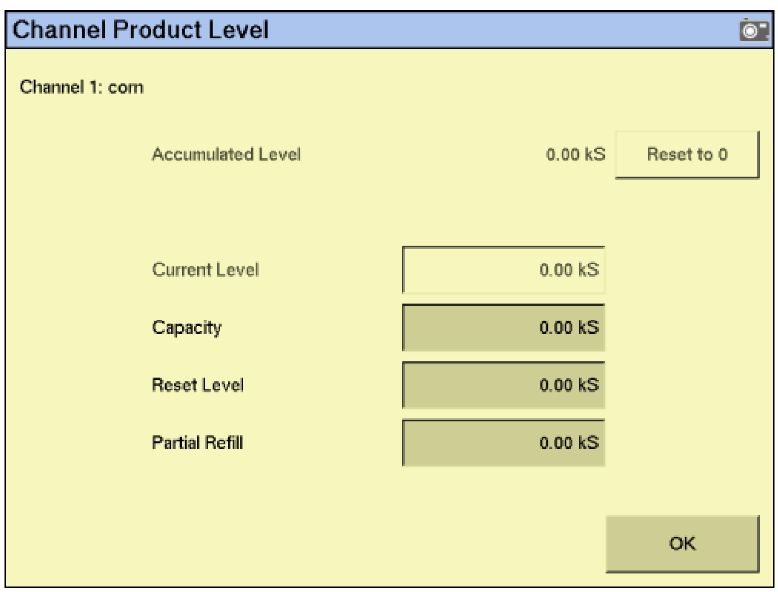
The ***material accumulator*** counts the amount of material that passes through each channel. The material accumulator value appears as the *Total* value on the main guidance screen.

You can reset this value on the application setup screen or by selecting the *Channel Product Level* screen from the main guidance screen:



To access the *Channel Product Level* screen from the main guidance screen:

1. Show the details of one of the channels. See Detailed channel information button, page 431.
2. Tap the  button:

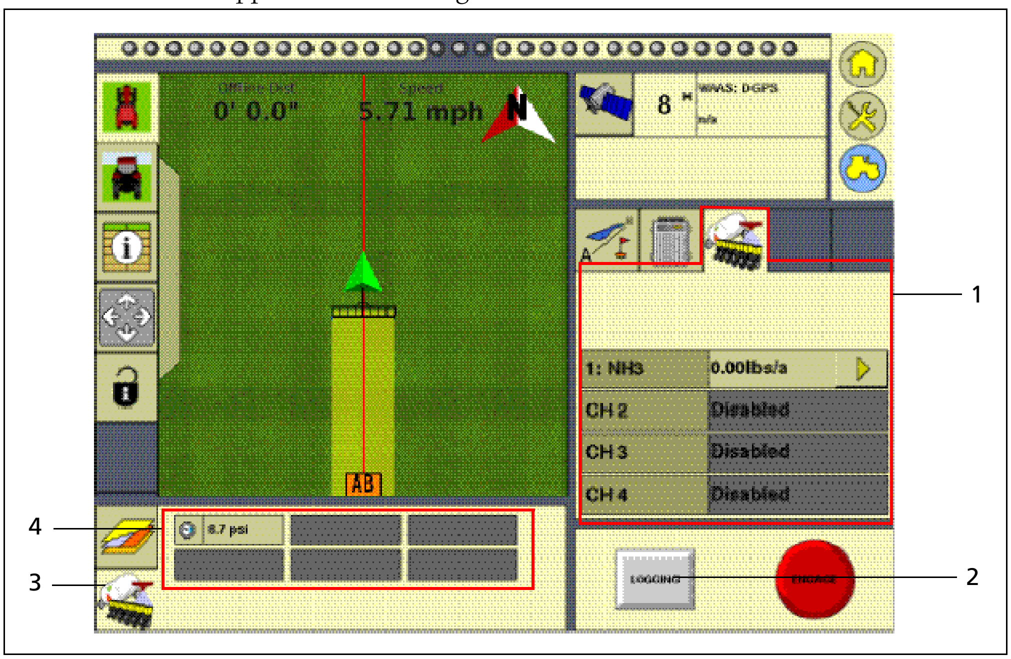


To reset the material accumulator and the air cart level, tap **Reset to 0**.

Operating an anhydrous unit

WARNING – When the implement is down and the master switch is in the On position, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

When you are running an anhydrous unit with the Tru Application Control plugin, several new items appear on the main guidance screen:



Item	Description
1	Anhydrous tab, see page 456
2	Logging on/off button
3	Row Information tab
4	Additional sensor readings. The sensors show the percentage of capacity.

Turning the anhydrous on or off

Implement lift switch installed

If an implement lift switch is ***not*** installed, see page 442.

To apply ammonia when an optional implement lift switch is installed, you must engage both the ***master switch*** and the ***implement lift switch***.

When the master switch is engaged, the **Logging** button is engaged. When the implement lift switch is engaged so the implement is down, the implement lift switch indicator changes to show this:

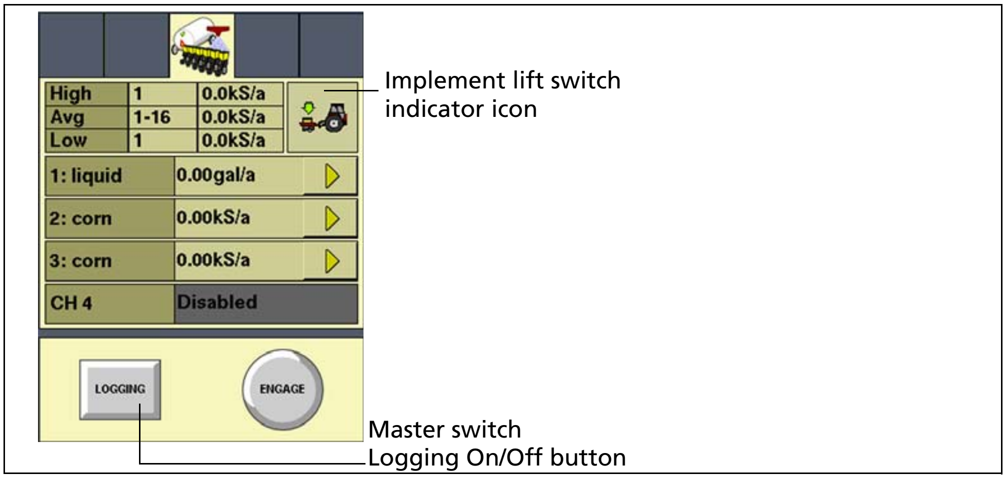
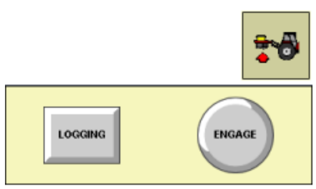
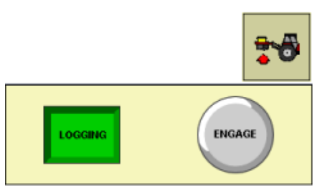
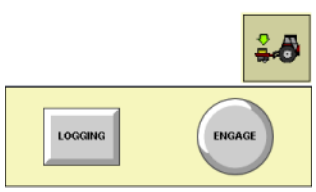
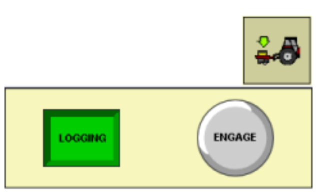


Illustration	**Status**	**Description**
	Implement switch is Off Master switch is Off	The implement is raised and the system is off.
	Implement switch is Off Master switch is On	The implement is raised. The master switch is turned on but logging does not occur because the anhydrous unit is not applying ammonia.
	Implement switch is On Master switch is Off	The implement is lowered, but the system is off and therefore not applying ammonia (or logging coverage).
	Implement switch is On Master switch is On	The implement is lowered and the system is on and logging coverage.

Implement lift switch not installed

For the anhydrous unit to apply ammonia, you must engage the ***master switch***.

When the master switch is engaged, the **Logging** button engages and the implement lowers. The **Logging** button and the position switch indicator change to show this:

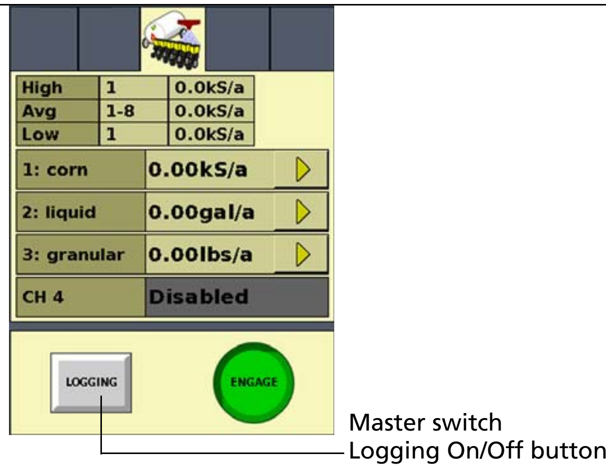
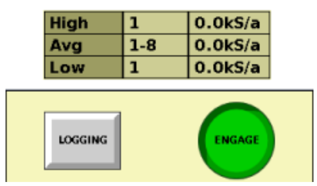
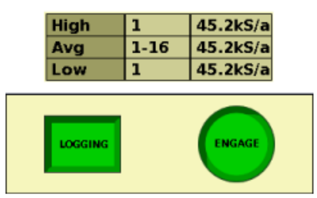


Illustration	Status	Description
	Master switch is Off	The implement is raised and the system is off.
	Master switch is On	The implement is lowered and the system is on and logging coverage.

The Anhydrous product (channel) tab (overview mode)

The Tru Application Control plugin can control up to 2 products on an anhydrous unit at once. In overview mode, the anhydrous tab on the right of the main guidance screen shows all of the configured channels and their current status:

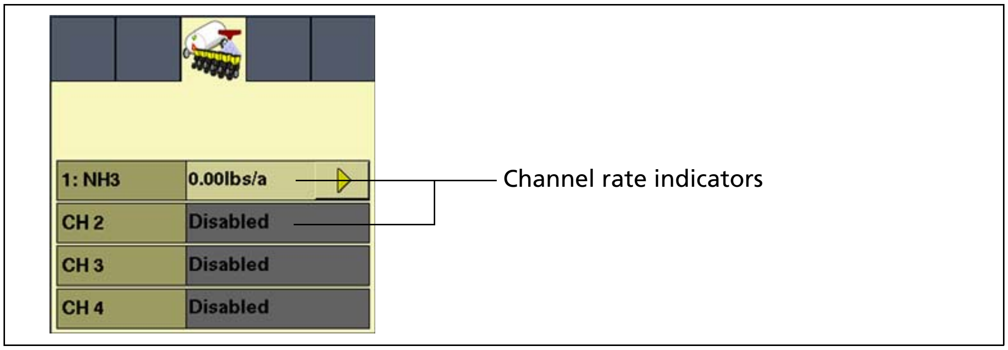
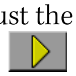
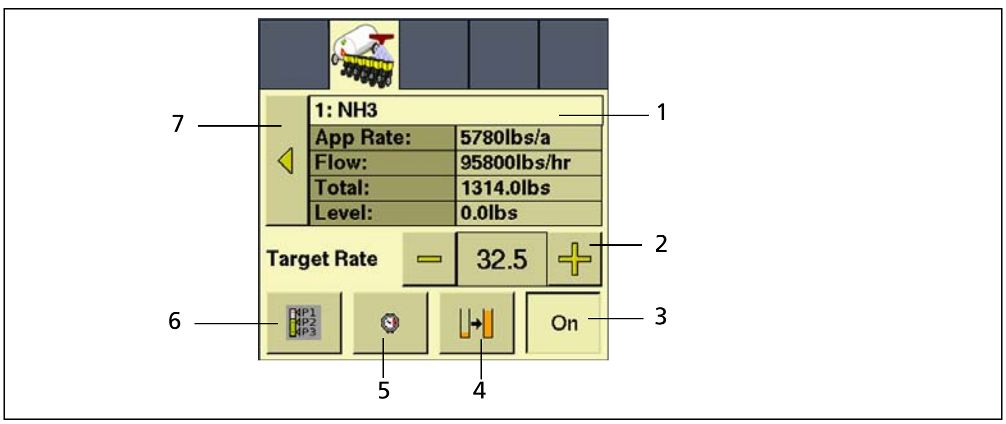


Figure 11.1 The anhydrous tab

Detailed channel information button

To adjust the settings for an individual channel, tap the detailed channel information button  next to the channel. The tab shows the details of that channel:



Item	Description
1	• Channel name • Current application rate • Channel flow rate • Total applied so far • Tank level
2	Target rate (with raise/lower buttons)
3	Channel on/off button
4	Quick link to the *Channel Product Level* screen. See page 413.
5	Tank pressure button

Item	Description
6	Preset target rate selection button: Select a different application rate from your preset entries. See page 406. ***Note –*** *This button is available only if you entered more than one target rate.*
7	Return button: Leave the detailed channel view and return to the overview.

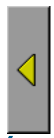
Note – *For anhydrous application, the actual channel rate and the target rate are shown in lbs/acre of N (nitrogen), not NH_3 (anhydrous ammonia).*

Turning individual channels on or off

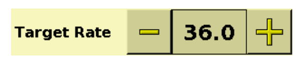
On the detailed channel tab, tap **On**. The channel is turned off when the **On** button is raised 

.

When you return to the channel status tab, the channel's current application rate appears as Off.

To return to the overview, tap .

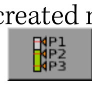
Adjusting the target rate (manually)



The Target Rate is the rate that you want the planter to plant at. To manually increase the target rate, tap **+**. To manually decrease the target rate, tap **–**.

The target rate adjusts by the Increment/Decrement value. See page 407.

Adjusting the target rate (with a preset rate)

If you created more than one preset rate for a material, the Preset Rate Selection button 

is available. Tap the button to select between the preset target rates.

The new preset rate appears between the **+** and **–** buttons.

Tank pressure button

The tank pressure button  enables you to enter the tank pressure from the nurse tank gauge. The system then calculates the density of the nitrogen or anhydrous ammonia.

To calculate the density:

1. Read the nurse tank pressure gauge.
2. Round the pressure down to the nearest pressure shown below.

Nurse tank temperature (F°)	Nurse tank pressure (PSI)	Pounds per cubic foot NH_3	Pounds per cubic foot Nitrogen
-28	0	42.5	35.0
-8	10	41.7	34.3
6	20	41.1	33.8
16	30	40.6	33.4

Nurse tank temperature (F°)	Nurse tank pressure (PSI)	Pounds per cubic foot NH_3	Pounds per cubic foot Nitrogen
26	40	40.2	33.1
34	50	39.8	32.8
42	60	39.4	32.4
50	75	39.0	32.1
58	90	38.6	31.8
68	110	38.1	31.4
77	130	37.7	31.0
86	155	37.2	30.6
96	185	36.6	30.2
105	215	36.1	29.7
115	250	35.6	29.3

For example, if the nurse tank pressure gauge reads 49 psi, use the 40 psi listing in the table. If the tank pressure gauge is inoperative, you can use the tank temperature to determine the approximate density values.

3. Enter the appropriate density.

Running the system in Monitor-only mode

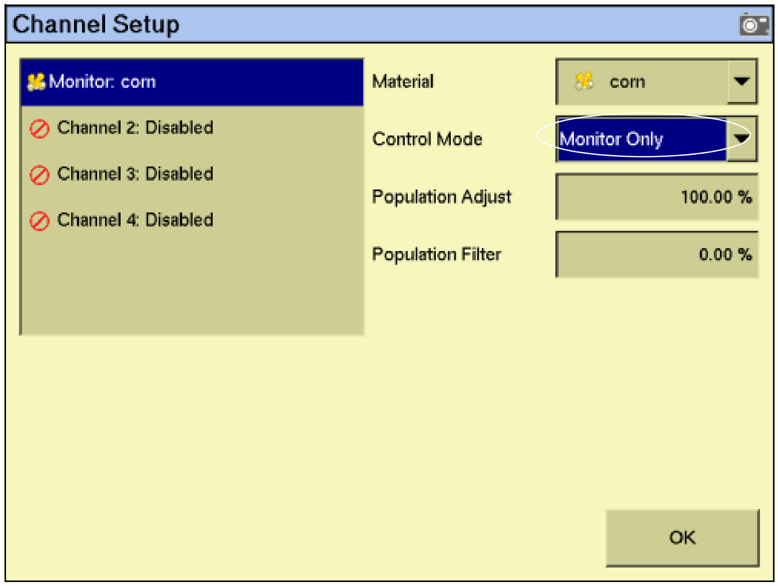
Note – *To use Monitor-only mode, the vehicle must have an implement switch installed.*

To receive rate information, the system must have the appropriate sensors (such as population sensors). If the system has block sensors (which do not report rate, they only report blockages), the display is unable to determine the current rate or calculate whether the rate needs to increase or decrease.

However, you can still run the system without rate information in Monitor-only mode.

After you configure the modules and enter the materials, but ***before*** you assign the materials to channels, do the following:

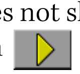
1. From the *4 Channel Setup* screen, tap **Channels**:



2. Select the channel to monitor and then select *Monitor Only* from the *Control Mode* drop-down list. A warning message appears.
3. Read the warning and then tap **OK**.
4. If necessary, adjust the *Population Adjust* and *Population Filter* settings:

Item	Description
Population Adjust	Scales the displayed population by a percentage (100% = no scaling).
Population Filter	Stabilizes the monitored population display (0% = no filtering, 99% = maximum filtering).

5. Tap **OK**.

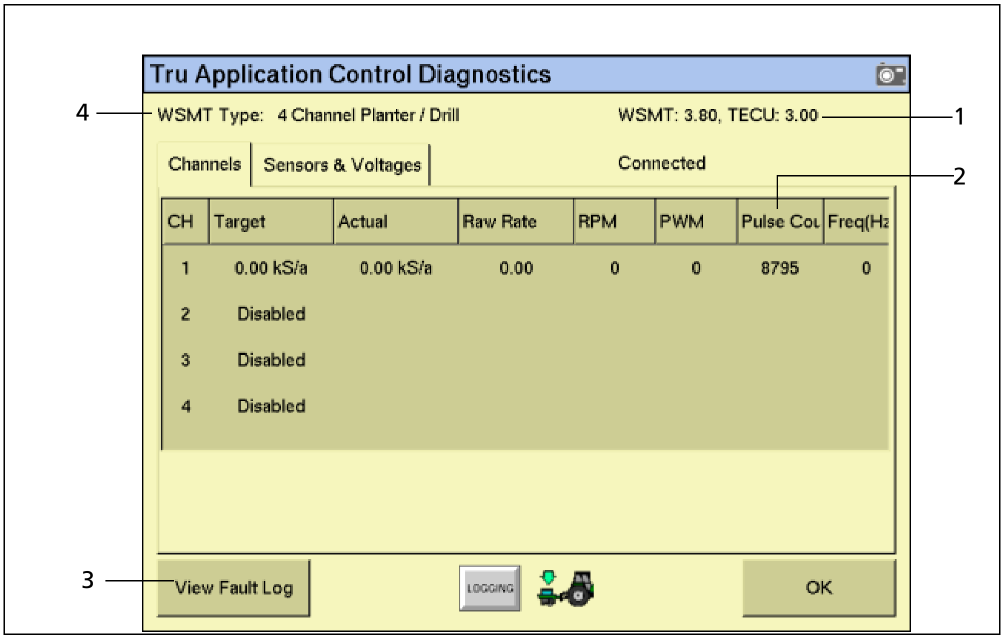
When you operate the plugin in the field, the system does not show rate information—it shows the text Monitor only. The channel detail button  is not available.

To disable Monitor-only mode:

1. Select the *Channel Setup* screen.
2. From the *Channel* list, select *Monitor*.
3. Set the *Material* list to *None*. A warning message appears.
4. Tap **OK**.
5. Re-assign materials to the channels.

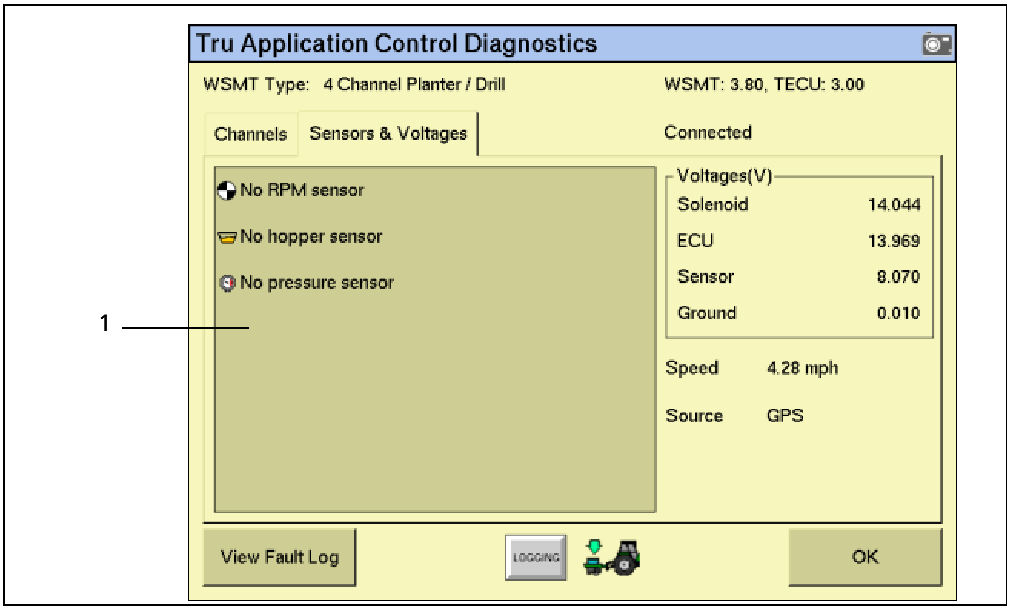
Obtaining diagnostics information about the Tru Application Control device

To obtain diagnostics information regarding the current status of the Tru Application Control device and the sensors, from the *Configuration* screen, select the Tru Application Control plugin and then tap **Diagnostics**. In the *Tru Application Control Diagnostics* screen, the *Channels* tabs shows the following information:



Item	Description
1	WSMT and TECU firmware versions.
2	The pulse count. The ***pulse accumulator***, which appears on the table as Pulse Count, counts the number of pulses that the system makes. You cannot reset the pulse accumulator value.
3	The **View Fault Log** button. Tap this button to view the Tru Application Control plugin faults.
4	The WMST module type.

The *Sensors & Voltages* tab shows the following information:



Item	Description
1	Sensor information.

Resetting the master module

CAUTION – Do not reset the master module unless you want to reset the channel calibration settings. Trimble recommends that you do not reset the system unless instructed to by Technical Support.

When you reset the master module, it clears the value on the module. The next time that you exit the setup menu, the FM-1000 integrated display re-sends the settings to the module.

To reset the memory (NOVRAM) of the master module:

1. From the *Configuration* screen, select the Tru Application Control plugin and then tap **Setup**. The *4 Channel Setup* screen appears.
2. Tap **Modules**. The *Tru Application Control Setup* screen appears.
3. Tap **Reset Master**. A confirmation dialog appears.
4. Tap **Reset**. The module is reset.

Tip – If you reset the master module, you may need to run the auto configuration twice.

Warning messages

When the Tru Application Control plugin is active, the system can display warning messages. The following messages, causes of the messages, and how to correct the situations are as follows:

Alarm #	Alarm	Probable cause	Solution
200	Master Switch Timeout – toggle Master to clear	1. Master switch ON at power up.	1. Move master switch to the OFF position.
		2. Master switch ON after leaving a setup screen.	2. Move master switch to the OFF position.
		3. Shorted or damaged tractor harness.	3. Check for damage on the tractor harness at the master switch connector.
		4. Defective master switch.	4. Inspect master switch for damage or replace.
201	Invalid Master Switch Assignment	External master switch is not assigned to the Auxiliary Input.	1. Assign master switch to the Auxiliary Input. Refer to Auxiliary Input/Function Assignment. 2. Decline use of Auxiliary Input Switch.
202	Ground Speed Failure	Active only in planter monitor mode. Seeds are detected when there is no ground speed.	
		1. Incorrect speed source setting or calibration.	1. Verify correct speed source setting and speed calibration on the *Ground Speed Calibration* screen.
		2. Defective speed sensor or harness.	2. Inspect speed sensor/harness for damage or replace speed sensor.
		3. Defective module or display.	3. Replace module or display.
203	Continuous Test Failure	Control conditions exceed the disk RPM limits.	
		1. Test Speed setting is set too high or low.	1. Enter an appropriate test speed.
		2. *Disk High Limit* and/or *Disk Low Limit* settings are incorrect.	2. Verify or enter appropriate *Disk High Limit* and/or *Disk Low Limit* values.
205	Control Channel Failure	1. Defective control valve.	1. Inspect control valve for damage or replace.
		2. Defective feedback sensor.	2. Inspect feedback sensor for damage or replace.
		3. Defective module harness or module harness fuse.	3. Inspect module harness for damage. Replace harness fuse.
		4. Defective module.	4. Inspect module for damage or replace.
206	Control Channel Unable to Control	1. Incorrect control channel settings.	1. Verify correct setup constants on the *Channel Configuration* screen. Perform a valve calibration.
		2. Incorrect feedback sensor installation.	2. Verify correct installation of the feedback sensor.
		3. Defective feedback sensor.	3. Inspect feedback sensor for damage or replace.

Alarm #	Alarm	Probable cause	Solution
207	Control Channel Unstable	1. Incorrect control channel settings.	1. Verify correct setup constants on the *Channel Configuration* screen. Perform a valve calibration.
		2. Incorrect feedback sensor installation.	2. Verify correct installation of the feedback sensor.
		3. Defective feedback sensor.	3. Inspect feedback sensor for damage or replace.
208	Control Channel Saturation Exceeded	1. Excessive speed. 2. Incorrect control channel settings. Desired rate too high for implement. 3. Target Rate too high.	1. Reduce speed. 2. Verify correct setup constants on the *Channel Configuration* screen. Perform a valve calibration and a spreader constant calibration. 3. Reduce target rate.
209	Control Channel High Limit Exceeded	Control is limited by high limit. Under-application is occurring. ***Note –*** *The system will not run faster than the High Limit value.*	1. Check and/or reduce speed. 2. Verify control channel setup (high RPM). 3. Perform new valve calibration. 4. Check and/or reduce target rate. 5. Inspect feedback sensor for damage. 6. Inspect control valve for damage. 7. Inspect harness/module for damage. 8. Decrease target rate.
210	Control Channel Low Limit Exceeded	Control rate is limited by low limit. Over-application is occurring.	1. Increase speed. 2. Verify correct setup constants (low RPM). 3. Perform valve calibration. 4. Increase target rate.
211	All Rows Failed	1. Seed meter drive malfunction.	1. Check seeding drive(s).
		2. Rows are not assigned to channel and channels are turned off.	2. Assign rows to channels.
212	Row Failure	The seed rate has fallen below the *Min Row Fail Rate* setting on the *Alarms Setup* screen.	
		1. Seed meter malfunction.	1. Verify proper planter operation.
		2. Dirty or defective seed sensor.	2. Inspect seed sensor for dirt or damage. Replace if necessary.
		3. Damaged planter harness.	3. Inspect planter harness for damage. Repair or replace.
		4. Defective module harness or module.	4. Inspect harness and module for damage. Replace if necessary.
		5. Out of seed.	5. Fill with seed.
213	High Population Limit Exceeded	The seed rate has exceeded the *High Population Alarm* setting on the *Alarms Setup* screen.	
		1. Seed meter malfunction or incorrect setup.	1. Verify proper planter operations/setup.
		2. Defective seed sensor.	2. Inspect seed sensor for damage. Replace if necessary.

Alarm #	Alarm	Probable cause	Solution
		3. Defective module.	3. Inspect module for damage. Replace if necessary.
214	Low Population Limit Exceeded	The seed rate has dropped below the *Low Population Alarm* setting on the *Alarms Setup* screen.	
		1. Seed meter malfunction or incorrect setup.	1. Verify proper planter operation/setup.
		2. Defective seed sensor.	2. Inspect seed sensor for damage. Replace if necessary.
		3. Defective module.	3. Inspect module for damage. Replace if necessary.
		4. Running out of seed.	4. Fill with seed.
215	High Pressure Limit Exceeded	The sensed pressure exceeds the *High Alarm* setting on the *Other Sensor Setup* screen.	
		1. Implement malfunction or incorrect setup.	1. Verify proper implement operation/setup.
		2. Defective pressure sensor.	2. Inspect pressure sensor for damage. Replace if necessary.
		3. Defective module.	3. Inspect module for damage. Replace if necessary.
216	Low Pressure Limit Exceeded	The sensed pressure is below the *Low Alarm* setting on the *Other Sensor Setup* screen.	
		1. Implement malfunction or incorrect setup.	1. Verify proper implement operation/setup.
		2. Defective pressure sensor.	2. Inspect pressure sensor for damage. Replace if necessary.
		3. Defective module harness or module.	3. Inspect module and/or module harness for damage. Replace if necessary.
217	Member Module Detection	The number of member modules does not match the system configuration.	
		1. Too few modules connected to system.	1. Verify correct module configuration setup on the *Tru Application Control Setup* screen.
		2. Too many modules connected to system.	2. Verify correct module configuration setup on the *Tru Application Control Setup* screen.
		3. Defective CAN/module harness.	3. Identify missing module in the *Tru Application Control Setup* list. Inspect CAN/module harness of the missing module for damage. Repair or replace harness.
		4. Blown module harness fuse.	4. Inspect module harness fuse of the identified module. Replace if necessary.
		5. Defective module.	5. Identify missing module in the *Tru Application Control Setup* list. Inspect missing module for damage or replace.

Alarm #	Alarm	Probable cause	Solution
		6. New module has been added to system.	6. Verify correct module configuration setup on the *Tru Application Control Setup* screen.
218	Pressure Sensor Detection	The number of pressure sensors connected differs from the number of sensors configured on the *Other Sensor Configuration* screen.	
		1. Defective Sensor.	1. Inspect pressure sensor for damage or replace.
		2. Defective module or damaged module harness.	2. Inspect module and/or module harness for damage. Replace if necessary.
		3. Additional pressure sensor detected.	3. Verify correct # ACC setting for each module.
219	Row Sensor Detection	The number of seed sensors connected differs from the number of sensors configured on the *Tru Application Control Setup* screen.	
		1. Defective seed sensor.	1. Inspect seed sensor for damage or replace.
		2. Damaged planter harness.	2. Inspect planter harness for damage. Repair or replace.
		3. Defective module or damaged module harness.	3. Inspect module and/or module harness for damage. Replace if necessary.
		4. Additional seed sensor detected.	4. Verify correct # ROWS setting for each module.
220	Row Sensors Installed Incorrectly	Rows are not detected sequentially on a module.	
		1. Incorrect seed row connections.	1. Verify seed sensors are connected sequentially on all modules as instructed in installation.
		2. Defective seed sensor.	2. Inspect seed sensor for damage or replace.
		3. Damaged planter harness.	3. Inspect planter harness for damage. Repair or replace.
		4. Defective module or damaged module harness.	4. Inspect module and/or module harness for damage. Replace if necessary.
221	Control Channel Invalid State	Internal system software error.	Turn system power Off/On. If condition persists, contact Technical Support.
222	Control Channel Setup Height Error	1. Implement hydraulic system malfunction.	1. Verify implement hydraulic system operation.
		2. Defective control valve.	2. Inspect control valve for damage. Replace if necessary.
		3. Incorrect feedback sensor installation.	3. Verify correct installation of the feedback sensor.
		4. Defective feedback sensor.	4. Inspect feedback sensor for damage or replace.

Alarm #	Alarm	Probable cause	Solution
		5. *Limit Max Output* is set too low. Re-calibrate the valve.	5. Set *Limit Max Output* to a higher PWM% on the *Valve Calibration* screen. Perform a new valve calibration.
223	Control Channel Max Feedback Unreachable	1. *Limit Max Output* set too low.	1. Set *Limit Max Output* to a higher level on the *Valve Calibration* screen. Perform a new valve calibration.
		2. Incorrect feedback sensor installation.	2. Verify correct installation of the feedback sensor.
		3. Defective feedback sensor.	3. Inspect feedback sensor for damage or replace.
224	No Control Channel Gain Steps Calculated	1. Implement hydraulic system malfunction.	1. Verify implement hydraulic system operation.
		2. Defective control valve.	2. Inspect control valve for damage. Replace if necessary.
		3. Incorrect feedback sensor installation.	3. Verify correct installation of the feedback sensor.
		4. Defective feedback sensor.	4. Inspect feedback sensor for damage or replace.
225	Hopper Sensor Low	1. Incorrect logic level setting on the *Other Sensor Setup* screen.	1. Verify correct logic level setting on the *Other Sensor Setup* screen.
		2. Dirty or defective hopper sensor.	2. Clean/inspect hopper sensor. Replace if necessary.
		3. Defective module harness or module.	3. Inspect harness and module for damage. Replace if necessary.
		4. Hopper empty.	4. Fill hopper.
226	RPM Sensor High Limit Exceeded	The sensed RPM exceeds the *High Alarm* setting on the *Other Sensor Setup* screen.	
		1. Implement malfunction or incorrect setup.	1. Verify proper implement operation/setup.
		2. Defective RPM sensor.	2. Inspect RPM sensor for damage. Replace if necessary.
		3. Defective module.	3. Inspect module for damage. Replace if necessary.
227	RPM Sensor Low Limit Exceeded	The sensed RPM is below the *Low Alarm* setting on the *Other Sensor Setup* screen.	
		1. Implement malfunction or incorrect setup.	1. Verify proper implement operation/setup.
		2. Defective RPM sensor.	2. Inspect RPM sensor for damage. Replace if necessary.
		3. Defective module harness or module.	3. Inspect module for damage. Replace if necessary.
228	Hopper Sensor Detection	The number of hopper sensors connected differs from the number of sensors configured on the *Tru Application Control Setup* screen.	

Alarm #	Alarm	Probable cause	Solution
		1. Defective hopper sensor.	1. Inspect hopper sensor for damage or replace.
		2. Defective module or damaged module harness.	2. Inspect module and/or module harness for damage. Replace if necessary.
		3. Additional hopper sensors detected.	3. Verify correct hopper setting for each module.
229	Hopper Sensors Installed Incorrectly	Hopper sensors are not installed sequentially on a module.	
		1. Incorrect hopper sensor connections.	1. Verify hopper sensors are connected sequentially on all modules.
		2. Defective hopper sensor.	2. Inspect hopper sensor for damage or replace.
		3. Defective module or damaged module harness.	3. Inspect module and/or module harness for damage. Replace if necessary.
230	Pressure Sensors Installed Incorrectly	Pressure sensors are not installed sequentially on a module.	
		1. Incorrect pressure sensor connections.	1. Verify pressure sensors are connected sequentially on all modules.
		2. Defective pressure sensor.	2. Inspect pressure sensor for damage or replace.
		3. Defective module or damaged module harness.	3. Inspect module and/or module harness for damage. Replace if necessary.
232	RPM Sensor Low Limit Exceeded With Control Channel Shutdown	The RPM has dropped below the *Low Alarm* level and the *Disable Control On Low Alarm* setting is enabled on the *Other Sensor Setup* screen.	
		1. Defective RPM sensor.	1. Inspect RPM sensor for damage. Replace if necessary.
		2. Damaged module harness.	2. Inspect module harness for damage. Repair or replace.
		3. Defective module.	3. Inspect module for damage. Replace if necessary.
		4. Low RPM.	4. Increase RPM.
233	Channel Delay or Precharge Enabled	Channel Delay or Precharge is enabled. During this, the control will run without ground speed or without the implement down.	1. Acknowledge alarm to activate control channels. 2. Acknowledge alarm and disable Delay or Precharge to stop control.
234	Control Channel Precharge Activation Timeout	Control Channel Precharge time has expired while the system is stationary. Control channel has stopped.	
		1. Ground speed is at zero. 2. Ground speed is less than Precharge Speed after Precharge time is expired.	Acknowledge the alarm and increase ground speed.

Alarm #	Alarm	Probable cause	Solution
235	New Member Module Detected	New member module has been found.	Assign sensors to the new module at the *Tru Application Control Setup* screen and its position.
236	Intermittent Member Module Detected	A member module that had previously failed communication has come online.	Inspect harness connections to this module.
237	Product Level Low	Calculated product level has dropped below alarm level.	Fill product bin and reset level.
240	Seeding Detected on a Control Off Row	Control Channel turned off and seed continue to be detected.	Check seed dispensing unit for proper shut off.
241	Control Not Active With Implement Lowered and Speed	Control will not operate while on a setup screen.	1. Navigate to the Run screen to activate the control. 2. Raise the implement and stop forward speed to clear alarm.
246	Master Switch Softkey Press	Warning of action associated with keypress.	Press the Control Start key to activate control.
602	8 Volt Supply Failure	The 8 V supply voltage is below 7.2 V or higher than 16 V.	
		1. Damaged planter or module harness.	1. Inspect planter harness or module harness for damage. Repair or replace harness.
		2. Defective seed or hopper sensor.	2. Inspect seed or hopper sensors connected to the identified module for damage. Replace sensors if necessary.
		3. Defective module.	3. Replace identified module.
603	Member Module Communication Failed	Communication with an active module has failed	
		1. Damaged CAN or module harness.	1. Identify missing module in the *Tru Application Control Setu*p screen list. Inspect CAN/module harness of the missing module for damage. Repair or replace harness.
		2. Blown module harness fuse.	2. Inspect module harness fuse, replace if necessary.
		3. Defective module.	3. Identify missing module in the *Tru Application Control Setu*p screen list. Inspect missing module for damage or replace.
604	ECU Voltage Out of Range Alarm	The ECU voltage is below 11 V or higher than 16 V.	
		1. Damaged CAN or module harness.	1. Inspect CAN/module harness of the identified module for damage.
		2. Defective module.	2. Inspect identified module for damage or replace.

Alarm #	Alarm	Probable cause	Solution
605	Solenoid Voltage Out of Range	The solenoid voltage is below 11 V or higher than 16 V.	
		1. Damaged CAN or module harness.	1. Inspect CAN/module harness of the identified module for damage. Repair or replace harness.
		2. Blown module harness fuse.	2. Inspect module harness fuse or replace.
		3. Defective module.	3. Inspect identified module for damage or replace.
606	Ground Offset Voltage Out of Range	1. Damaged/shorted Actuator Harness.	1. Inspect Actuator Harness for damage around the PWM and Servo valve connections. Repair or replace harness.
		2. Defective PWM valve driver or Servo valve driver.	2. Inspect PWM or Servo valve drivers for damage and replace if necessary.
		3. Defective module.	3. Inspect identified module for damage and replace if necessary.

CHAPTER

12

The GreenSeeker Plugin

In this chapter:

This chapter describes how to configure and operate the GreenSeeker RT200 variable rate and mapping system plugin on the FM-1000 integrated display.

Introduction

The GreenSeeker RT200 Variable Rate Application and Mapping System is a tool for variably applying agricultural chemicals based on real-time measurements of the crop. The sensors measure normalized difference vegetation index (NDVI) of the plants while traversing the field.

The applicator provides the ability to variably apply agricultural chemicals in real-time, as the applicator passes over the crop. The NDVI-based variable rate algorithm and parameters may be selected in the field, and all rate changes are then made "on the go," so there are no lengthy delays between evaluating the crop and application. When applying fertilizer or other material, the NDVI, the target rate, and the applied rate are logged. Some rate controllers connected via serial cable to the FM-1000 do not respond with an 'As Applied' value.

The RT200 GreenSeeker sensors emits light at two specific wavelengths and measures the reflected light. The microprocessor in the sensor analyzes the reflected light and calculates the resulting Index value. The data from each sensor is collected by the Interface Module which is processed, and then transmitted to the FM-1000 integrated display in the cab.

The FM-1000 integrated display displays the NDVI in real-time, and sends the appropriate rates to the applicator's rate controller. The rate controller may be an "internal" plug in to the FM-1000 integrated display such as the EZ-Boom system, the True Application Control (TAC) system or the Field-IQ system. Alternatively, the application rates may also be sent via the Serial Rate Control option as a system plugin.

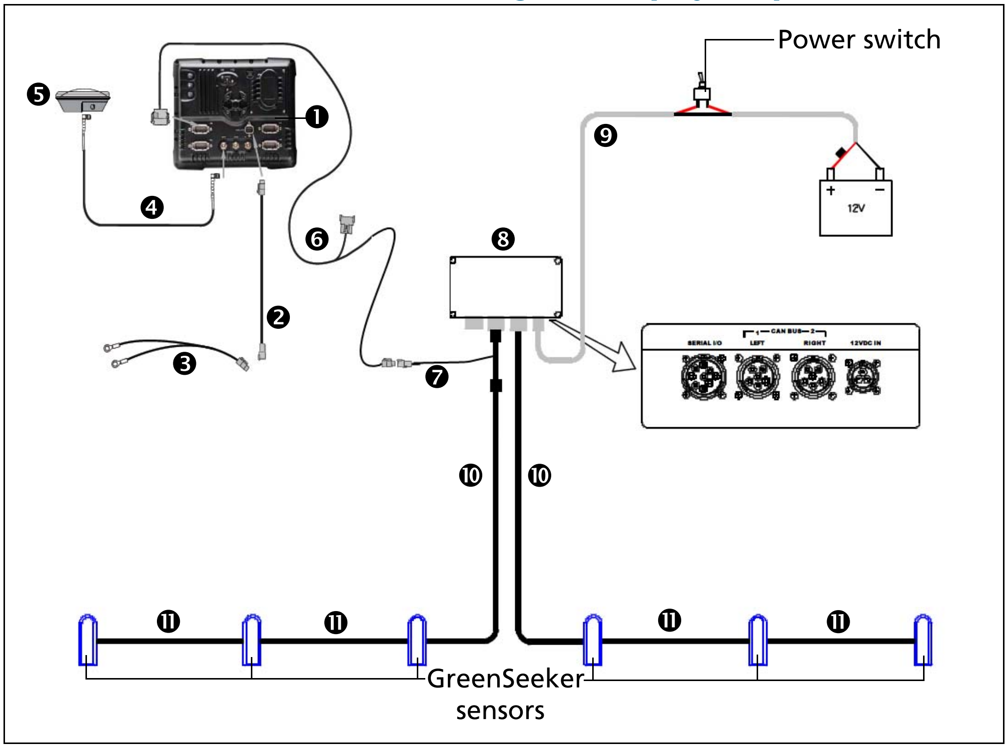
Definitions

The following terms occur throughout this chapter, and on the GreenSeeker plugin software. Becoming familiar with the terms will make using the GreenSeeker plugin much easier.

Term	Definition
GDD	**Growing Degree Days.** A measurement of heat units since planting above a prescribed base temperature.
N	**Nitrogen fertilizer**
NVDI	**Normalized Difference Vegetation Index**. Commonly used to measure plant health and vigor. NDVI = (NIR_reflected - Red_reflected)/(NIR_reflected + Red_reflected).
NUE	**Nitrogen Use Efficiency**. A percentage of nitrogen taken up by the plant. For example, an NUE of 60% means that 6 lbs. of nitrogen fertilizer is expected to be used by the plant that year for every 10 lbs. applied. For more information, go to www.nue.okstate.edu.
NRS	**Nitrogen Rich Strip**. This reference strip/area allows for determining the amount of nitrogen being made available to the plant by the environment (mineralization, etc), and importantly this year's expected maximum yield potential and response to additional nitrogen.
RI	**Response Index**. Provides an indication of how the crop will respond this season to additional N
VI	**Vegetation Index**. A value that is calculated (or derived) from sets of remotely-sensed data that is used to quantify plant health, stress, and vigor.
VRA	**Variable Rate Application**. Based on information supplied to a rate controller, the rate of fertilizer or other chemical applied.

GreenSeeker primary components

GreenSeeker RT200 with FM-1000 integrated display components



Item	Description	Trimble part number
❶	FM-1000 integrated display	93100-01
❷	FM-1000 power cable	66694
❸	FM-1000 basic power cable	67258
❹	8 m GPS TNC/TNC RT angle cable	50449
❺	AG25 GNSS antenna	68040-00S
❻	FM-1000 / FM-1000 to CAN w/port replicator cable	75407
❼	GreenSeeker to display cable	77704
❽	RT200 interface module	900-1-047
❾	30' RT200 power cable	400-1-276
❿	20' RT200 interface module cable	400-1-277
⓫	20' RT200 sensor cable	400-1-265-240

Interface module

The Interface Module contains circuitry to interface boom mounted sensors with the FM-1000 integrated display. The interface module has CAN, serial, and power connections.

The module is an environmentally sealed enclosure which can be installed inside or outside the cab.

GreenSeeker sensors

Reflectance readings are taken by the sensor. These units generate their own illumination for use in any lighting condition, day or night.

When the unit is on, a red band of light will be observed directly below the rectangular sensor window. The sensor is designed for an optimal height of 28" – 48" over the plant/crop canopy to be sensed. The field of view (width of the sensor measurement) is approximately 24" within the sensor's optimal height range.

Sensor mounting bracket

Sensors are typically mounted to a standard stainless steel bracket supplied by Trimble. These brackets are designed to fit most boom structures, and are typically mounted with U-bolts.

Care and maintenance

To maintain the high performance of your GreenSeeker RT200 variable rate application and mapping system, do the following:

- Each day, or during applicator re-fill, check the GreenSeeker sensor detector and light source windows for dust and dirt, and wipe clean with a soft rag.
- The GreenSeeker system should not be left outdoors during extreme weather conditions. Wide temperature variations are hard on electronics and fluid seals, and may reduce the operating life of the system.
- DO NOT store a GreenSeeker system with the sensors facing upward. Doing so may allow water to collect around the windows and gaskets, causing seal failures in those areas. Also direct sunlight can in some cases focus enough energy into the sensor to damage the detector.

***Note** – There are no field serviceable components of the electronic system; do not attempt any field repair of a malfunctioning interface module or sensors. If you experience operating problems, contact your local dealer or Trimble representative.*

Field preparations for Nitrogen application

***Note** – The following instructions apply to the most common Nitrogen applications. Check algorithms for specific instructions. For updated specific algorithm instructions, go to www.GreenSeeker.com.*

Field information

Before the GreenSeeker applicator can be utilized to apply nitrogen (N) across a field, a nitrogen rich reference strip (NRS), or "calibration" area must be established prior to or shortly after planting. This reference strip is used to determine the amount of nitrogen being made available to the plant by the environment (mineralization, etc) and importantly, this year's expected maximum yield potential and response to additional nitrogen. The ideal NRS would run the length of the field, but it should at least be 400 feet long.

Establishing a calibration reference area

Establish the NRS in a representative reference portion of the field (i.e. not in high spot or low spot). The rate of N necessary to establish a NRS is crop and region dependent, and should be equivalent to the highest rate necessary to satisfy crop needs throughout the growing season.

The rest of the field is referred to as the Non-Reference (Non-Ref) portion. It may also be referred to as the N-limited area or farmer practice region.

For best results, the RT200 should be used to "read" the NRS and apply N at growth stages dependent upon the crop algorithm used. For most supplied algorithms this is typically:

- Wheat: Feekes growth stage 4-6
- Corn: V8-V12.

For updated specific algorithm instructions, see www.GreenSeeker.com.

In order for the sensors to accurately determine NDVI for topdressing (or sidedressing), plant coverage should be at least 50%. The RT200 system with RT Commander can use the sensor mounted booms to read the NRS, or the GreenSeeker Hand Held sensor can be used to determine field conditions.

To collect sensor readings for the NRS, the boom mounted sensor (or handheld sensor) should be passed over the crop at 32 – 48" above the canopy. A large area of the NRS and Non-Reference portion of the field should be sensed to accurately determine their respective NDVI values. Once the NDVI values have been measured, they can be entered into the GreenSeeker plugin on the FM-1000 integrated display. (This can be done automatically with the boom mounted sensors, or manually entered if the GreenSeeker hand-held is used).

If the response is variable across the field, select an area where the difference between the Reference and the Non-Reference areas are most apparent. This assures that the algorithm will determine a rate that utilizes the highest yield potential prediction and maximum response to N for that year.

In order to estimate yield potential, most algorithms utilize an environmental factor (Growing Degree Days or Days From Planting), which takes into account the weather and length of time that has passed since planting.

Be aware that different GDD variations are used for different crops, and to obtain the GDD value the planting date and sensing date must be known. Regional values for GDD may be found on the internet.

For more information regarding GDD regional values go to http://www.ntechindustries.com/software, and browse to the *Where to Find GDD Information* link.

Field setup

To prepare a reference area, do the following:

1. If past practice was a 100% pre-plant application of N, decrease pre-plant N application rate of the field to a level at least half of previous total N applied during non GreenSeeker management practice.

   For spring or winter wheat, if application rate has historically been 100 lbs N/acre, decrease the rate to 50 lbs N/acre.

   For corn, if application rates have historically been 200 lbs N/acre decrease to 75 to 125 lbs N/acre.

   For corn or wheat, be aware that a sandy soil type, or heavy rainfall may require additional N application to maintain the NRS as a non-limiting reference area.

2. Prior to, or shortly after planting, establish the NRS (Nitrogen Rich Strip) in a representative portion of the field (i.e. not in a historically high spot or low spot) and then apply an applicators width swath of N. The rate of N applied should be high enough to satisfy crop N needs in a good year.

   For spring or winter wheat, the N rate should be at least 100 lbs N/acre.

   For corn, the N rate should be at least 200lbs N/acre. Keep in mind that a sandy soil type or heavy rainfall may require additional N application to maintain the NRS as a non-limiting reference area.

3. Make certain to use a permanent land marker or temporary marker to ensure that the NRS can easily be found later in the season. You may also want to establish the location of the NRS by noting it as an A-B line or flag on the FM-1000 integrated display.

   The ideal NRS would run the length of the field, but it should at least be 400 feet long.

4. At appropriate crop growth stage, take readings of the NRS and an adjacent part of the field yet to be fertilized. For most supplied algorithms the following is typical:

   – Wheat: Feekes growth stage 4-6

   – Corn: V8-V12.

5. Find the area where the nitrogen rich strip is most apparent in comparison to the rest of the field (this indicates greatest potential for the crop).

6. Take sensor readings with RT200 or Hand Held sensor for input to your selected Crop Algorithm.

7. Be sure to match nozzles and/or rate control system to maximize response time and performance for each field's requirements.

   For more information, see Delivery System and Liquid Control, page 489 for more details, and be sure to consult your application equipment and rate control systems manuals as applicable.

Field preparations for user defined rate

The RT200 system can be used to apply other materials than Nitrogen. The GreenSeeker plugin for the FM-1000 integrated display permits a custom algorithm to be entered which is a table of product values versus the NDVI value. These values are entered into the *Custom Formula Application* table, see Defining a Custom Table, page 485.

Note – *The values in the table are only an example; the grower/consultant must develop these rates. Also be aware of the rate range ability of your specific rate controller and nozzles used to achieve these results.*

Example of field calibration

The photo shows a grower using a GreenSeeker hand-held to measure the NDVI of a crop the grower knew the approximate desired rate for.

Note – *The NDVI can also be measured using the GreenSeeker RT200 by observing NDVI values on the GreenSeeker Run screen or using the calibration function.*

Operating the GreenSeeker Plugin

The GreenSeeker system requires the one of the following applications to be active on the FM-1000 integrated display:

- The EZ-Boom 2010 automated application control system
- The Tru Application Control system
- The Field-IQ system
- Serial Rate Control system

Calibrate the GreenSeeker system through the Run screen on the FM-1000 integrated display. Before calibration, you must collect or input reference strip data to the FM-1000 integrated display: Do this with either the boom mounted sensors on the RT200, or with the GreenSeeker hand held sensor prior to application.

If you use the RT200 interface module for variable rate control, you must set up the application equipment and rate controller to match the expected delivery rate commands.

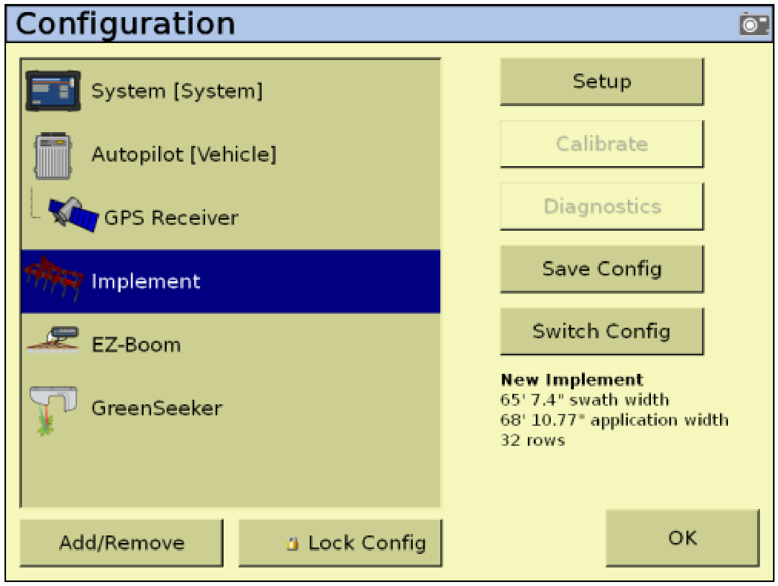
Preparing the GreenSeeker plugin

To configure variable rate application on the FM-1000 integrated display, do the following:

1. Power up the RT200 interface module and the rate controller (if required).

   The RT200 interface module's green Power LED will blink three times accompanied by three beeps when the unit is first turned on. Following this, the Status LED will blink in time with each transmission of sensor data over the CAN bus. Expect to see a brief green flash, followed by a red flash at the I/M message rate (typically at 0.5sec) - this indicates that data from the left (green flash) and right (red flash) CAN ports is being transmitted.

2. Install the GreenSeeker plugin. For more information, see Adding or removing a plugin, page 194:



3. From the Home screen, load the field to be sprayed.

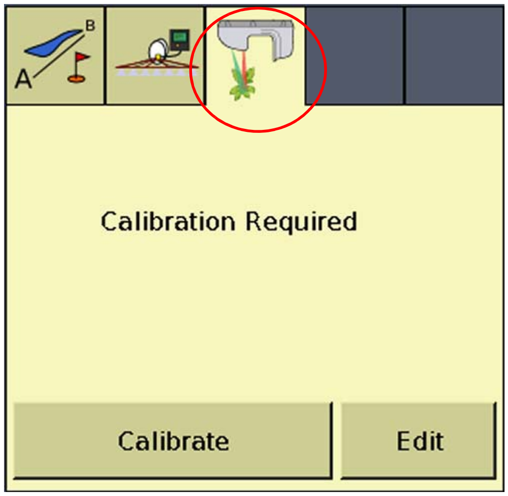
GreenSeeker plugin screen

The control items in the GreenSeeker tab on the Run screen depend on what you previously selected, for example, a crop algorithm, or a custom table.

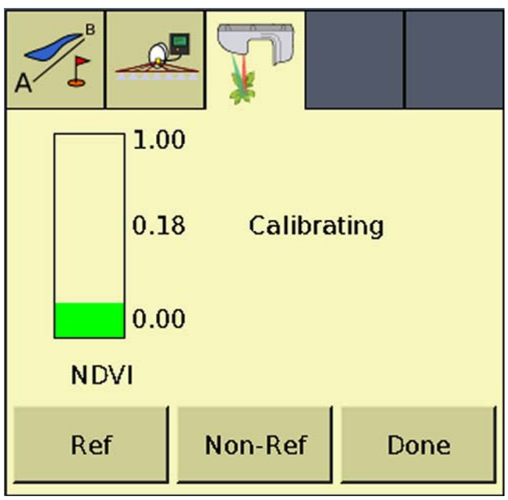
The Calibration Required message appears when a new job/event is first opened and a crop algorithm has been previously used or selected.

***Note** – If you want to use a custom table, but see this screen, tap Edit and then follow the custom table instructions found in the FM-1000 Integrated Display User Guide. If a custom table has been previously selected, the* Calibration Required *message will not display.*

1. From the Run screen, select the GreenSeeker plugin tab:



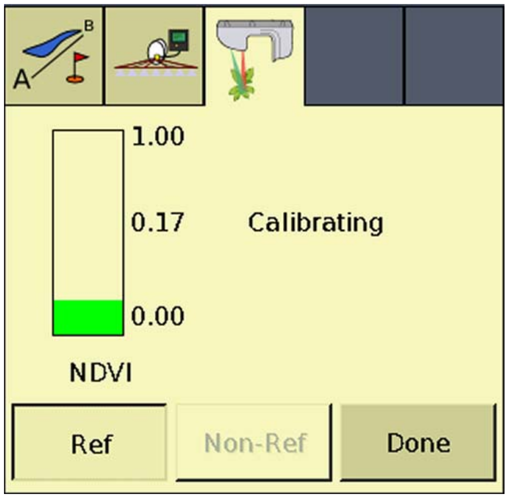
2. Tap **Calibrate**:



   The GreenSeeker plugin tab now includes **Ref** and **Non-Ref** buttons, along with a NDVI bar graph showing the real-time combined average NDVI from the RT200 module.

3. Position the vehicle at the reference locations.

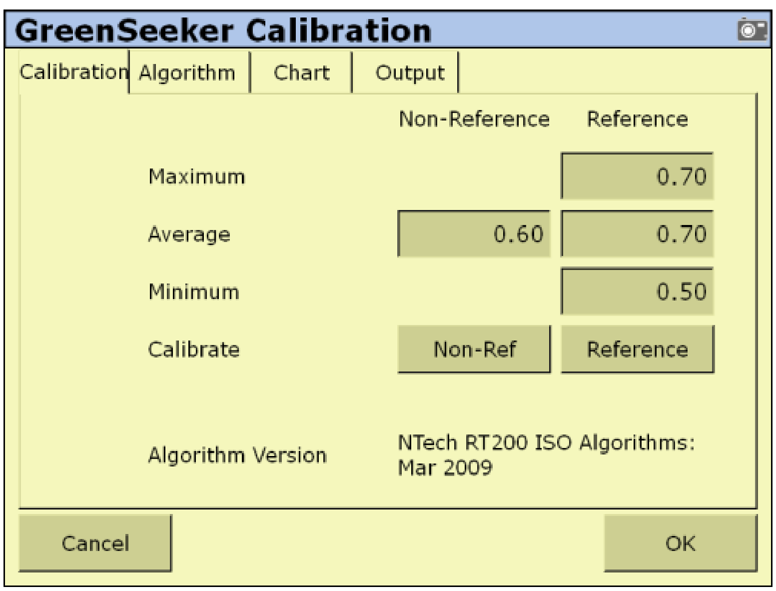
4. To record NDVI data from the reference strip, tap **Ref**, drive the reference strip and then tap **Ref** again to end recording:



5. To record NDVI data from the non-reference strip, tap **Non-Ref**, drive the non-reference strip and then tap **Non-Ref** again to end recording.

***Note** – As the NDVI is collected, the data is stored in respective fields on the GreenSeeker calibration page. Keep the vehicle moving as you collect the data; stopping in one location affects the average values. The Ref and Non-Ref buttons change to a lighter color when selected or active.*

6. Tap **Done**:

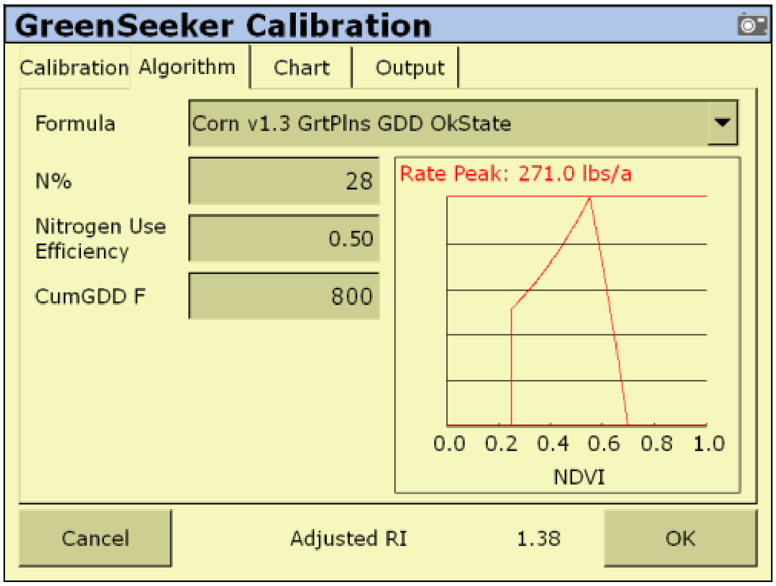


You now see the values that were collected in Step 4 and Step 5.

***Note** – To collect fresh data from this screen, tap the **Non-Ref** or **Reference** buttons. You will not see the new values until you deselect the respective button.*

***Note –** To manually override or input data, select the various fields and then use the screen keypad.*

7. When you are satisfied with the data, select the *Algorithm* tab:



8. Select either an existing algorithm, or Custom Table to create a new algorithm, from the *Formula* list. For more information, see Defining a Custom Table, page 485.

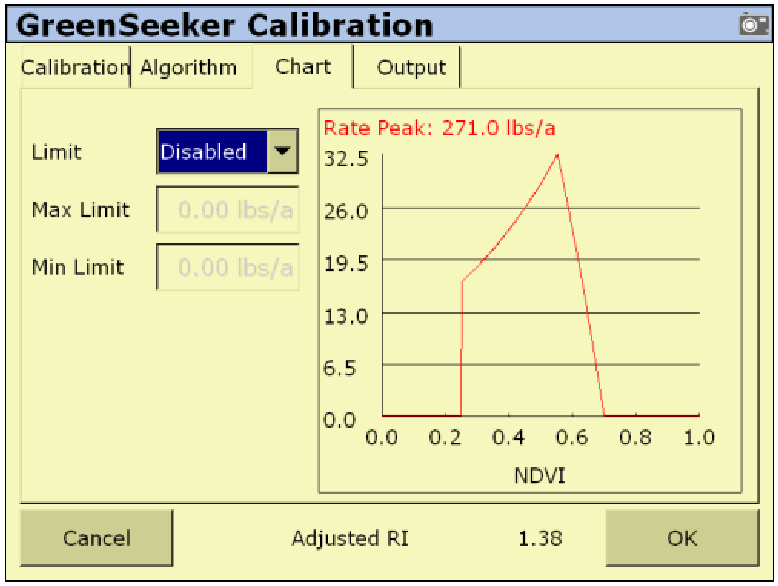
***Note –** The formula selected for your last job will still be current, so you are often just verifying that the correct formula is being used.*

9. Input the various fields as required.

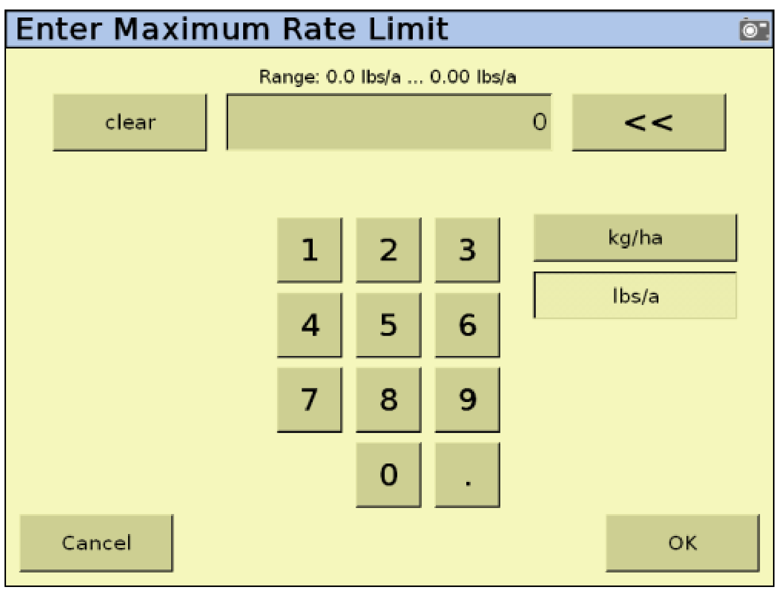
   The fields displayed will change based upon the formula selected; some fields, such as *Nitrogen Use Efficiency* have default values that are formula specific, but all are able to be changed by selecting the field and using the screen keypad.

***Note –** You may need to reference the specific algorithms instruction for more detailed explanation of the CumGDD F, or similar fields. For example the CumGDD F for the corn v1.3 GrtPlns GDD OKState is Cumulative Growing Degree Days, Base 50F. For specific algorithm instructions, go to www.GreenSeeeker.com.*

10. Select the *Chart* tab:

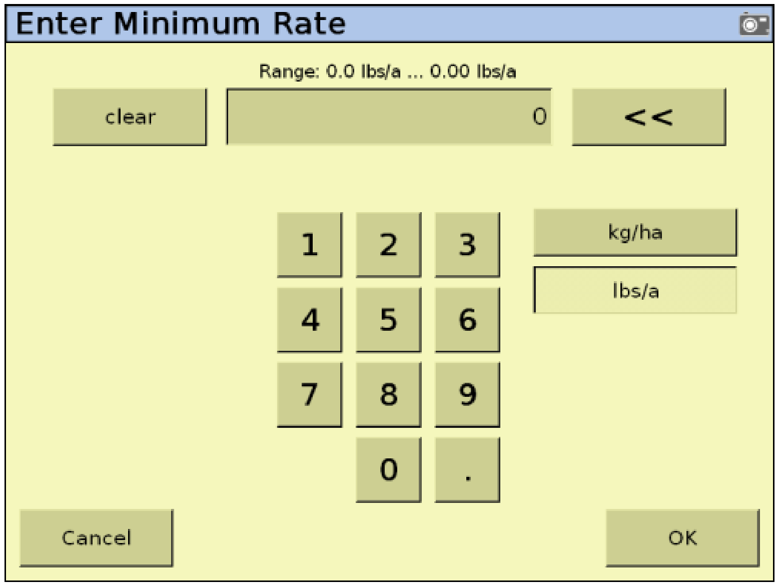


11. In the *Limit* list, select *Enabled* or *Disabled*.
12. If necessary, enter a *Max Limit* value based on rate controller or application equipment limitations:



13. Tap **OK**.

14. Enter a *Min Limit* value:

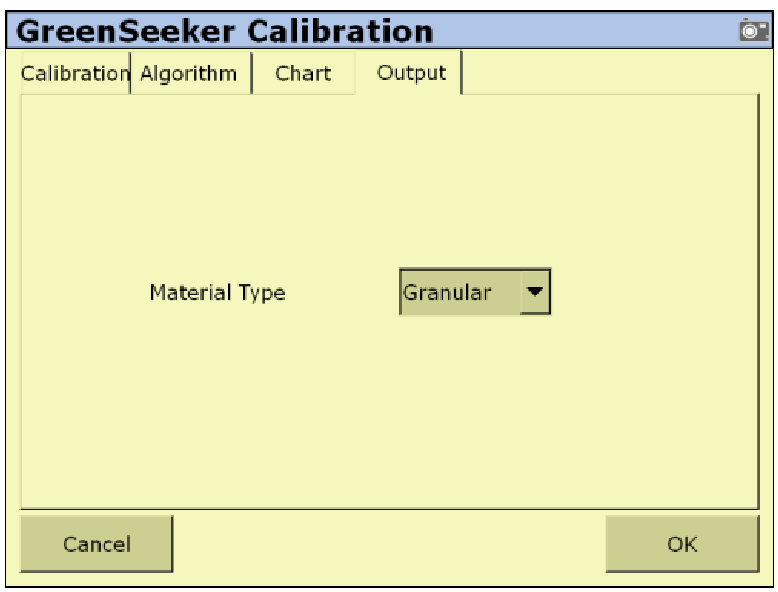


15. Tap **OK**.

***Note** – Maximum and minimum settings will limit the rate commands given to the rate controller.*

16. Review the application chart for each job to determine the appropriate nozzle selections and/or application equipment settings.

17. Select the *Output* Tab:



18. In the *Material Type* list, select either Granular, or Liquid.

19. Tap **OK**.

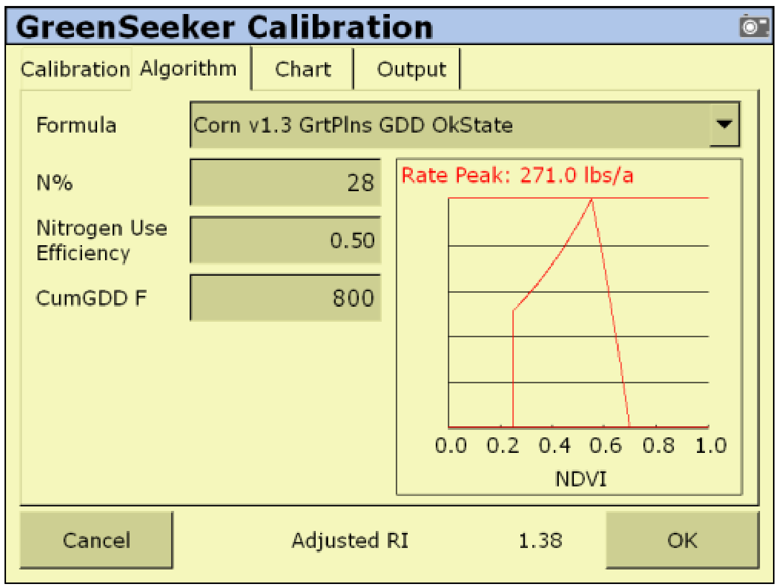
Defining a Custom Table

For growers or crop consultants, having crop historical knowledge allows them to determine different crop input requirements based upon biomass/size of the crop/plant. An example of this type of use would be variable rate application of defoliant in cotton, or desiccant in potatoes. For these cases, the field is scouted or "field calibrated" to determine areas of the field that require different rates of defoliant.

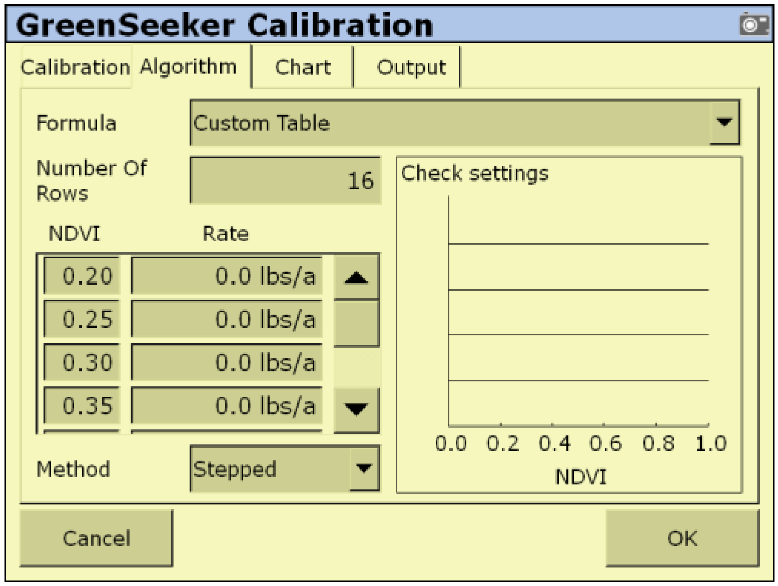
The RT200 system, or a GreenSeeker hand-held can be used to obtain the NDVI values in representative areas of the field, and then a table can be created with NDVI values corresponding to application rates.

To create a custom table, do the following:

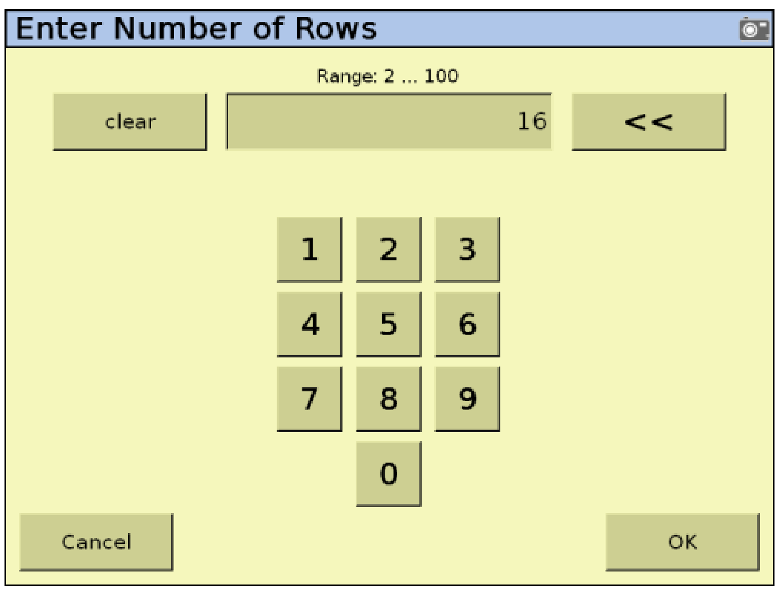
1. From the *GreenSeeker Calibration* screen, select the *Algorithm* tab.



2. In the *Formula* list, select Custom Table.



3. Select the *Number Of Rows* field.

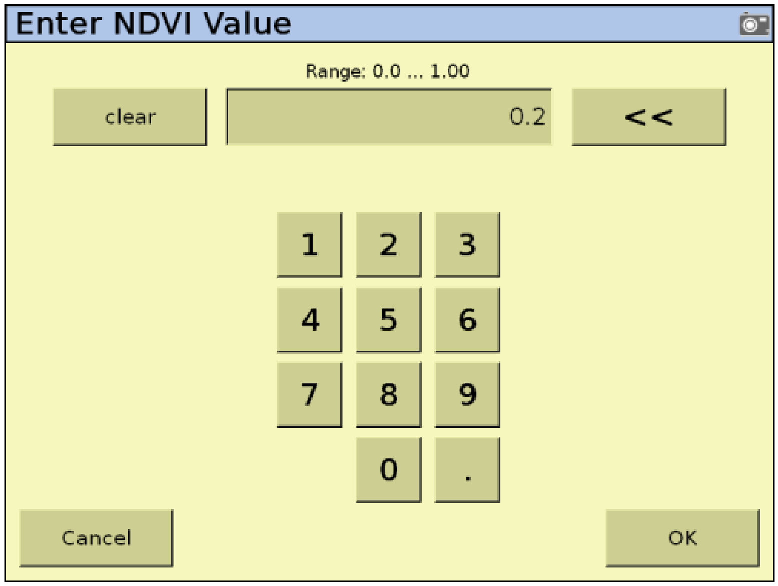


4. Use the on-screen keypad to enter a value and then tap **OK**.

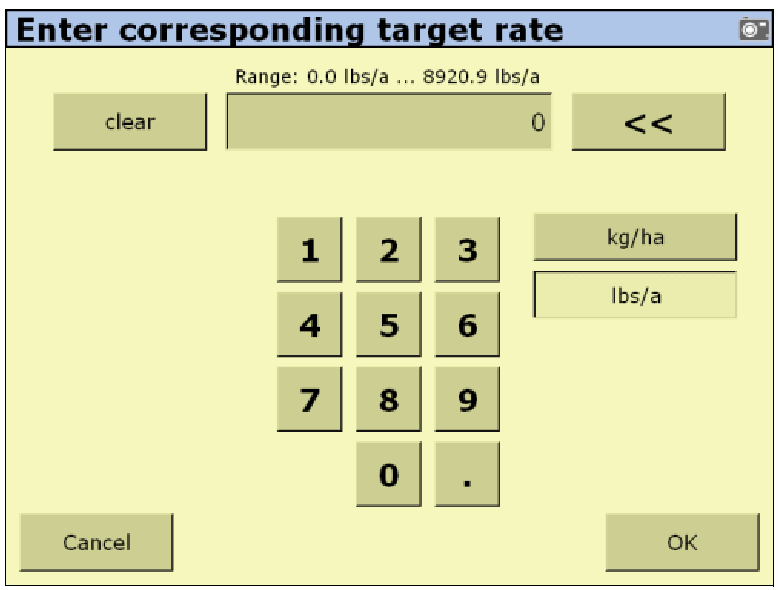
   The number of available *NDVI* and *Rate* fields are dictated by the value entered in the *Number Of Rows* field.

   Typically the number of rows for the custom table are two more than the number of filed calibration areas sampled. This allows for starting at zero and ending at .99 NDVI.

5. Select a *NDVI* field to enter a custom value.

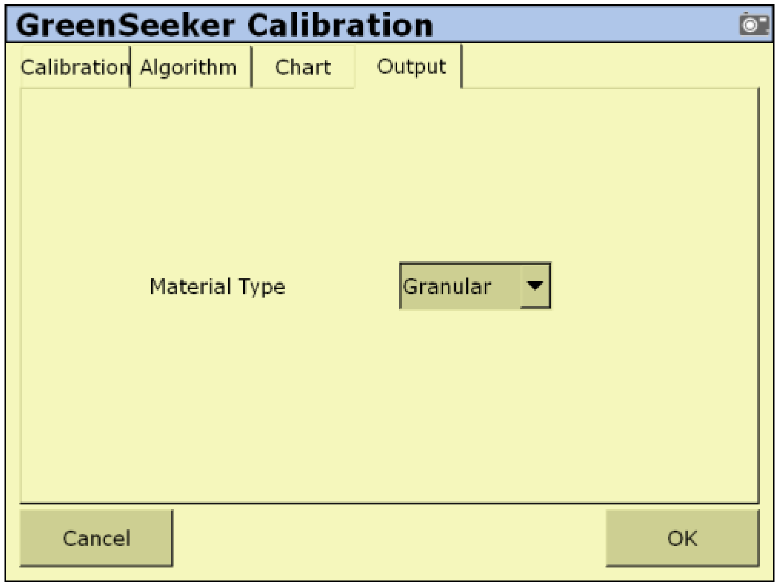


6. Tap **OK**.
7. Select a corresponding *Rate* field to enter a custom value.



8. Tap **OK**.
9. In the Method list, select either *Stepped* or *Interpolated*.

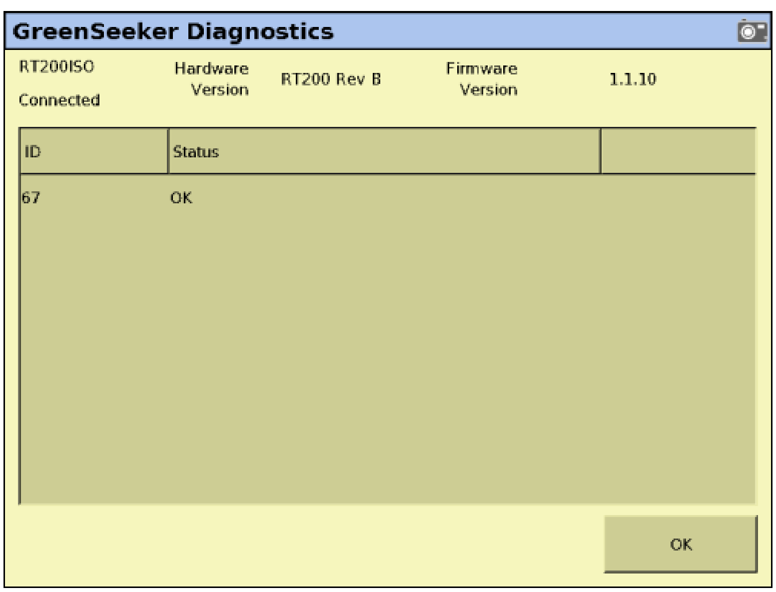
10. Select the *Output* Tab.



11. In the *Material Type* list, select either Granula, or Liquid.
12. Tap **OK**.

GreenSeeker diagnostics

The *GreenSeeker Diagnostics* screen reports on the quantity of sensors detected on system and provides any error conditions.



The appearance of both the hardware and firmware version information at the top of the diagnostics screen indicates that the FM-1000 integrated display and RT200 are communicating.

Erroneous data

The RT200 system monitors the sensors for proper operation, and if a sensor reports erroneous data, the data is not included in the rate control calculation. Erroneous data can come from mud on the sensor lenses, sensors viewing concrete, snow, wet asphalt, or other non soil or non plant surface.

Error conditions

Error conditions include sensors disconnected from the CAN bus, or a sensor transmitting invalid data.

Invalid data could occur if the sensor malfunctions, or more commonly, if it is seeing a target other than plants and soil. For example, when setting up the system, the sensors may be pointed into the air, or against wet asphalt; either of these will likely generate an error code from a sensor.

Error	Code	Description
-1	Red > NIR	Red reflectance higher than NIR
-2	BOTH < .01	Both reflectances are below 0.01
-3	RED < .01	Red reflectance below 0.01
-4	NIR < .01	NIR reflectance below 0.01
-5	BOTH > .98	Either reflectance above 0.98
-9	NIR < .015	NIR net reflectance below 0.15

To access the GreenSeeker diagnostics, do the following:

1. From the Home screen, tap .
2. In the *Current Configurations* screen, tap **Configure**.
3. From the *Configuration* screen, select the GreenSeeker plugin and then tap **Diagnostics**.

Application information

Delivery System and Liquid Control

As with any variable rate system, the minimum and maximum rates obtainable are dependent upon the delivery system. The RT200 interface module is capable of "requesting" any rate, but the actual rates delivered are dependent upon the rate controller and its components. Most liquid rate control systems control or "throttle" the pressure of the system to affect flow and application rate. There are also more advanced delivery systems that use two booms, multiple nozzles, or special pulsing solenoids on each nozzle, to obtain larger rate changes.

When using the RT200 with a typical liquid delivery system, it is important to match nozzle sizes to expected delivery rates. After the appropriate reference strip readings, GDD, and selection of crop type are input into RT Commander,

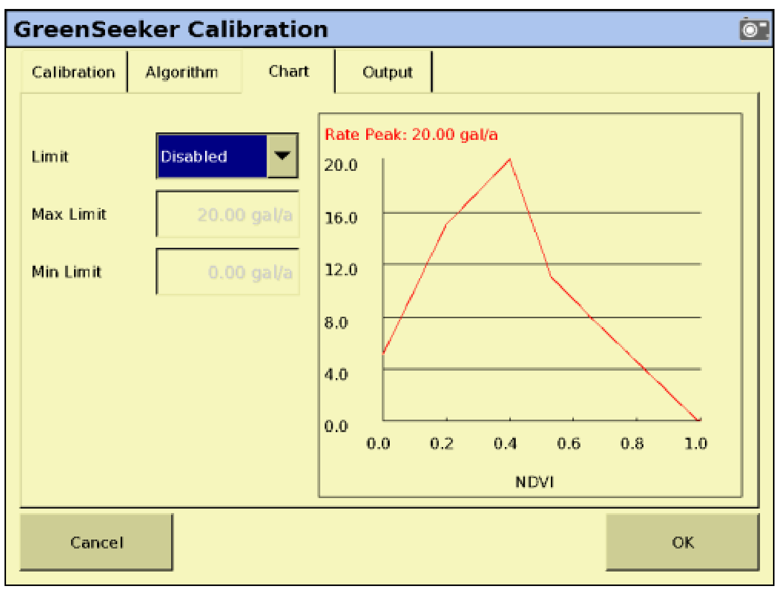
the application graph can be accessed to show the prescription rates at various sensor NDVI readings. Depending upon what delivery system is used, there will be actual minimum and maximum rates obtainable. These will be dependent upon components like the pump, control valve, nozzles, and boom plumbing sizes.

The GreenSeeker plugin for the FM-1000 integrated display has features that allow for minimum and maximum rates to be set, regardless of the crop algorithm prescription. Once a nozzle set is chosen, the minimum should be set at the lowest rate the nozzles will still give adequate pattern/performance. Maximum rates may be limited by rates that lessen atomization or drift.

Selecting a nozzle

It is usually best to match nozzles to the lower midrange of the typical rates shown on the application graph. Ultimately, it is up to the grower or crop consultant to determine the minimum or maximum rates and nozzles which are most appropriate

Example



If most of your NDVI readings (in the area of the field not in the NRS) are around 0.53, and your review the application graph shows at 0.53 NDVI you should be applying 15GPA, then you should choose a nozzle that will have the ability to change rates above and below this NDVI reading. You might choose a nozzle that puts out 12.5GPA at its lowest pressure (e.g. 20psi) and 21GPA at its highest pressure (e.g. 60psi). Since the penalty to under-fertilize (harm yield) is usually greater than to over-fertilize (waste fertilizer), it may be best to choose a strategy similar to the one shown here. You will need to modify your values to fit your circumstances and meet the local field and delivery system conditions.

Best practice

To ensure best performance from the GreenSeeker variable application system, do the following:

– Do not use high pressure spray on the sensors when rinsing the machine. Even though all of the connectors and modules are fully sealed, there is the potential of leakage from a pressurized stream.

– Every time the spray tank is filled, take a soft cloth and wipe the lenses of the sensors. Try to check sensors at least once a day during full time operation.

– Be more aware of cleaning the sensors directly behind the machine.

– If you do not have ground protection devices on the boom, such as gauge wheels or skids, take extra care to not run the boom into the ground. Also, be aware of sensor vulnerability to stationary structures in the field.

  Sensors are usually mounted on the front of the boom and do not have rigid protection.

– Rinse the boom at the end of every day. Do this to keep the system clean and remove to any corrosive materials. Doing so will greatly extend the life of your machine.

– Sensors should be re-calibrated after approximately 1000 hours of use due to possible changes in light output. This is generally done at the factory, or authorized service center.

– Sensors have an optimum operating range of 32" - 48" above the crop canopy. 38" is the optimum height, and must be measured from the top of the crop to the rectangular LED window of the sensor.

– Make sure all wiring harness components remain fastened to the boom as to not obstruct the view of the sensors and are free of any pinch points from boom folding and movement.

CHAPTER

13

The TrueGuide Plugin

In this chapter:

This chapter describes how to configure the TrueGuide™ implement guidance plugin to work with the FM-1000 integrated display.

Note – *Firmware version 2.0 or later of the FM-1000 integrated display and the NavController II firmware version 5.10 are required for TrueGuide implement guidance.*

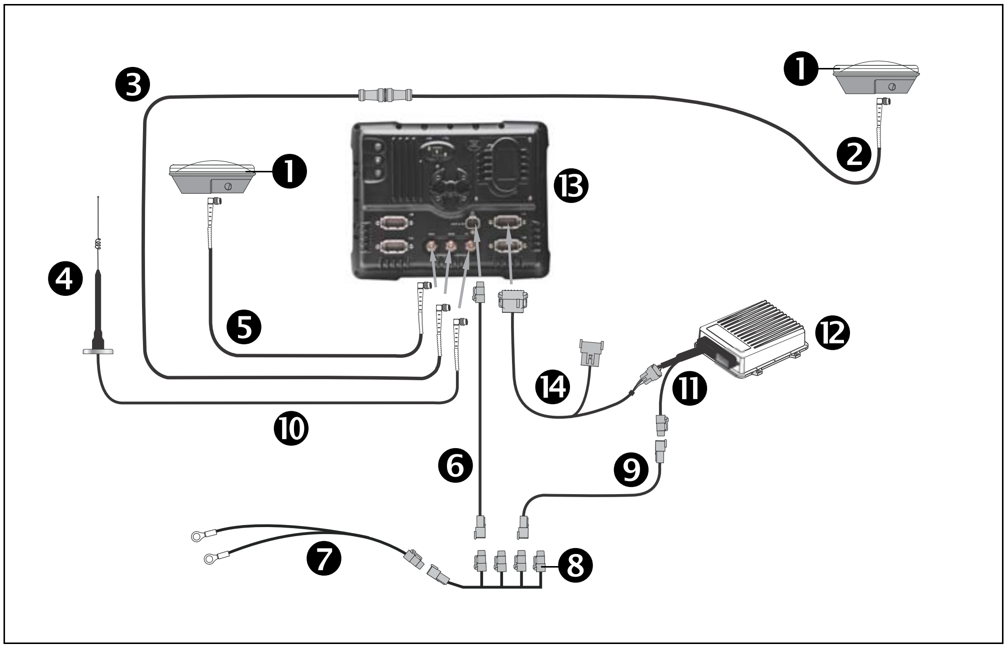
The TrueGuide plugin for the Autopilot automated steering system and the FM-1000 integrated display supports a second GPS receiver (an FM-1000 internal or external *Ag*GPS receiver) on the implement that is used to measure the position of the implement so that the Autopilot system can adjust the position of the tractor to pull the implement on line.

The TrueGuide system supports towed implements for front-steered and tracked tractors (4x4 articulated tractors are not supported in version 3.0).

To achieve the highest performance from TrueGuide implement guidance, the Autopilot system on the tractor must have a good calibration. An Autopilot system that is calibrated very aggressively may need to be set up with a more neutral calibration when used with TrueGuide implement guidance.

Connecting the TrueGuide implement guidance system

Once the TrueGuide implement guidance system has been professionally installed, add the FM-1000 integrated display as shown:



CAUTION – Connecting the Port Replicator on the FM-1000 to NavController II cable ⓮ to the P4 or P12 connector of the NavController II harness ⓫ will result in damage to the FM-1000 integrated display, and will void the warranty.

Item	Description	Trimble part number
❶	A25 GNSS antenna (x2)	68040-00S
❷	LMR400 65" extension cable	67473
❸	Coaxial cable	68295

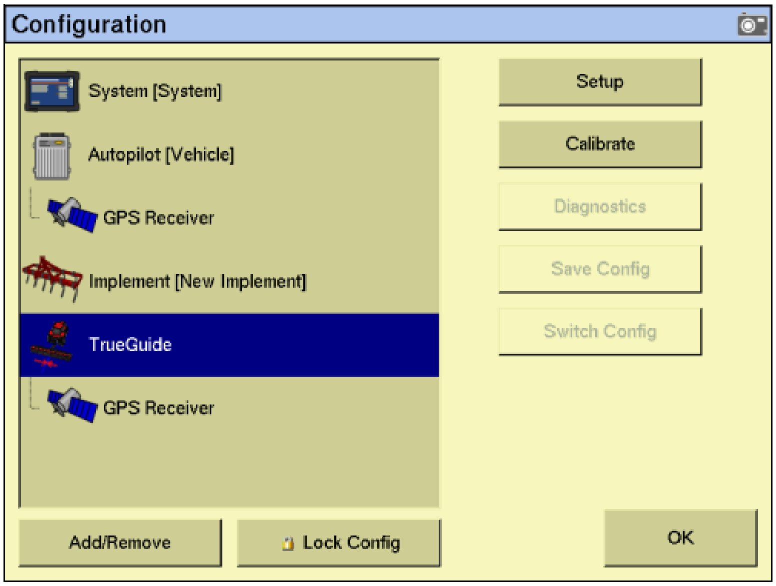
Item	Description	Trimble part number
❹	Antenna	2822-10
❺	Right-angle cable	50499
❻	FM-1000 power cable	66694
❼	Basic power cable	67258
❽	Main power bus cable	67259
❾	Power adaptor cable	67095
❿	NMO to TNC 20' antenna cable and base	62120
⓫	Main NavController II cable	54601
⓬	NavController II	55563-00
⓭	FM-1000 integrated display	93100-02
⓮	FM-1000 to NavController II cable with port replicator	75741

Configuring the TrueGuide implement guidance system

TrueGuide implement guidance must have:

- The Autopilot automated steering system installed on the tractor. For instructions on how to install the Autopilot system, see the *Autopilot Automated Steering System Installation Instructions* relevant to your vehicle.
- Stable implements. Implements that are unstable, such as sprayers with large flotation tires, will cause rocking in the antenna that will be greater than the performance improvements on the ground.

- Both the Autopilot option and the TrueGuide plugin activated on the FM-1000 integrated display. For more information see Adding or removing a plugin, page 194).



TrueGuide implement setup

Before using the FM-1000 integrated display with the TrueGuide system plugin, select and configure a new or existing implement. For more information, see Chapter 7, Implement Configuration.

***Note** – You can update existing (saved) implements with implement geometry to support TrueGuide implement guidance.*

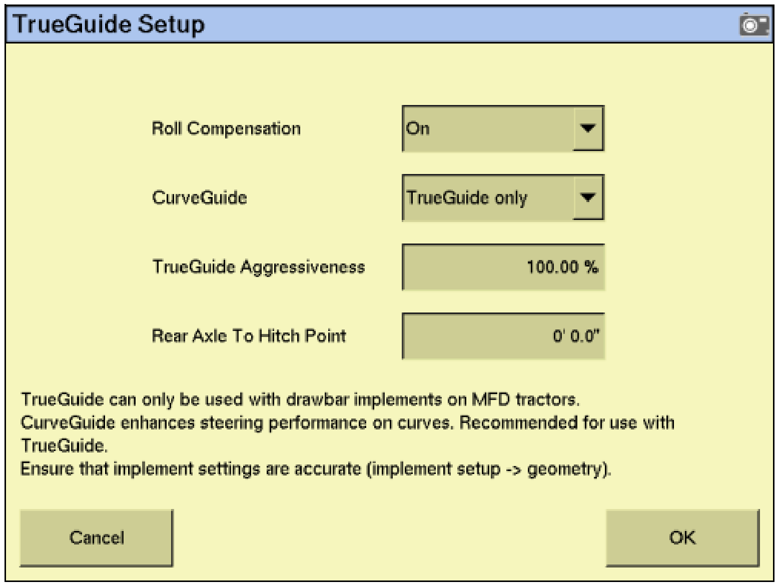
***Note** – Antenna offsets are provided when the antenna cannot be placed directly over the working point of the implement. These offsets should be minimized whenever possible.*

Settings on the *Geometry* tab are required for implement modelling. When configuring an implement for the TrueGuide system, the following antenna offsets are required:

Offset	Description
Hitch to ground contact point	Measured from the tractor hitch pin to the soil engagement point that the implement rotates around.
Antenna front/back	Measured from the implement working point to the center of the GPS antenna (if mounted).
Antenna left/right	Measured from the center of the implement to the center of the GPS antenna (if mounted)
Antenna height	The working height of the GPS antenna

Setting up the TrueGuide system

1. From the *Configuration* screen, select the TrueGuide plugin and then tap **Setup**:



2. Enter the required global settings:

Setting	Description
Roll compensation	• On: Applies roll corrections from the tractor. • Off: Applies no roll corrections.
CurveGuide	• Off: The system does not anticipate curves. • TrueGuide only: Enables the system to anticipate curves to make corrections for TrueGuide guidance only. • Always On: Keeps CurveGuide on at all times.
TrueGuide Aggressiveness	Sets the default aggressiveness; the recommended aggressiveness is 100%. For more information, see TrueGuide system aggressiveness settings, page 502.
Rear axle to hitch point	Enter the distance between the fixed axle for conventional tractors, or the center of rotation for tracked tractors, and the draw bar.

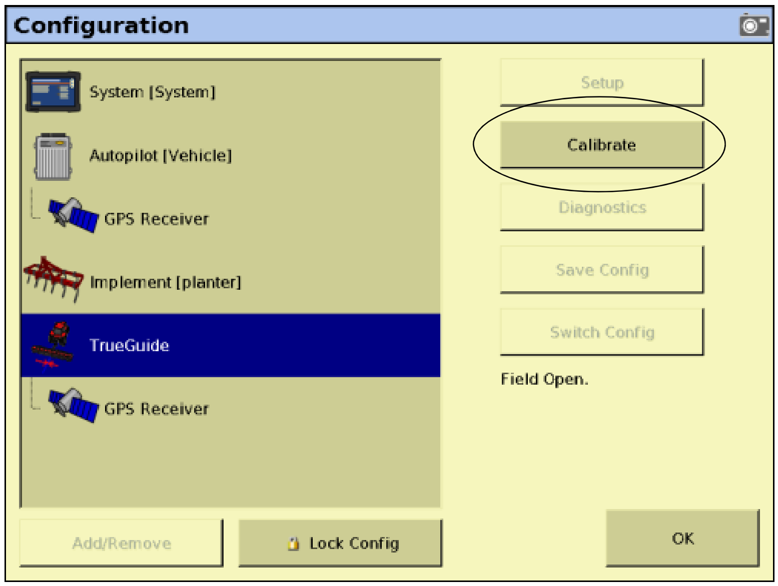
3. Tap **OK**. The *Configuration* screen appears.

Calibrating the TrueGuide implement guidance system

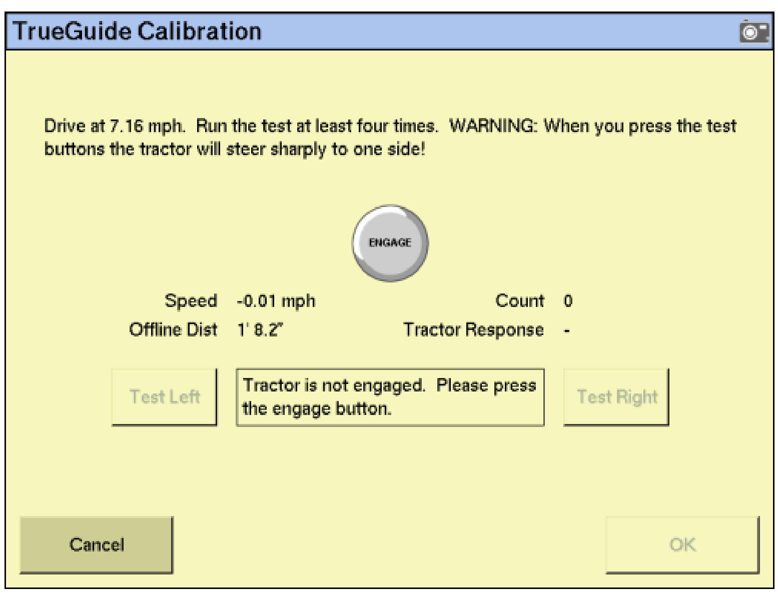
To calibrate the TrueGuide system, you must have a field open in the Run screen with an A – B line configured. For more information on opening a field and creating an A – B line, see Introduction to field features, page 44

From the Run screen, do the following:

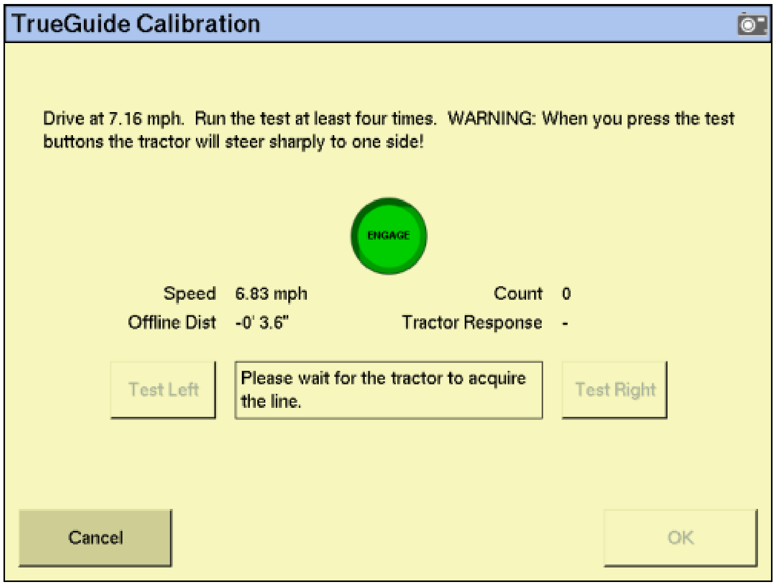
1. Tap . Without closing the field, the *Configuration* screen appears.



2. Select the TrueGuide plugin and then tap **Calibrate**.
3. In the *TrueGuide Calibration* screen, tap **Next** and then follow the on-screen instructions:



4. Complete the test at least four times and then tap **OK**:



5. In the *Calibration* screen, tap **OK** to return to the open field.

Engaging and disengaging the TrueGuide system

To engage the Autopilot and the TrueGuide systems using the FM-1000 integrated display, you must have a guidance line defined and the vehicle must be within the engage limits of the system.

To manually engage the systems, do one of the following:

- Tap the **Engage** button on the main guidance screen.
- Press the optional remote engage foot pedal or rocker switch.

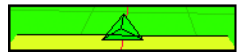
To disengage the systems, do one of the following:

- Tap the **Engage** button on the main guidance screen.
- Press the optional remote engage foot pedal or rocker switch.
- Turn the steering wheel.

The system automatically disengages when:

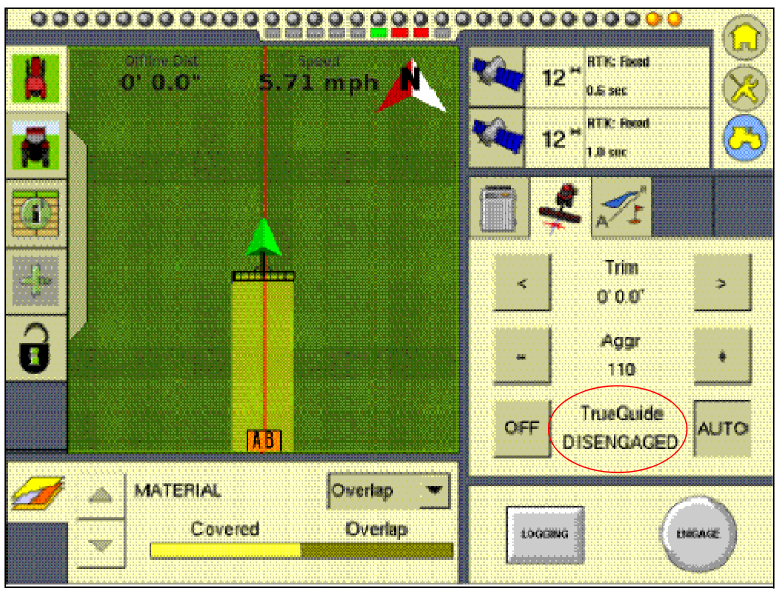
- The vehicle or implement is outside the engage limits.
- GPS positions are lost on the implement or on the vehicle.
- *Minimum Fix Quality* is not maintained and the system receives low accuracy positions (for example, no corrections).

Engage status indicators

Engage status	Button color	Vehicle icon color
Ready to engage		
Engaged		
Cannot engaged		

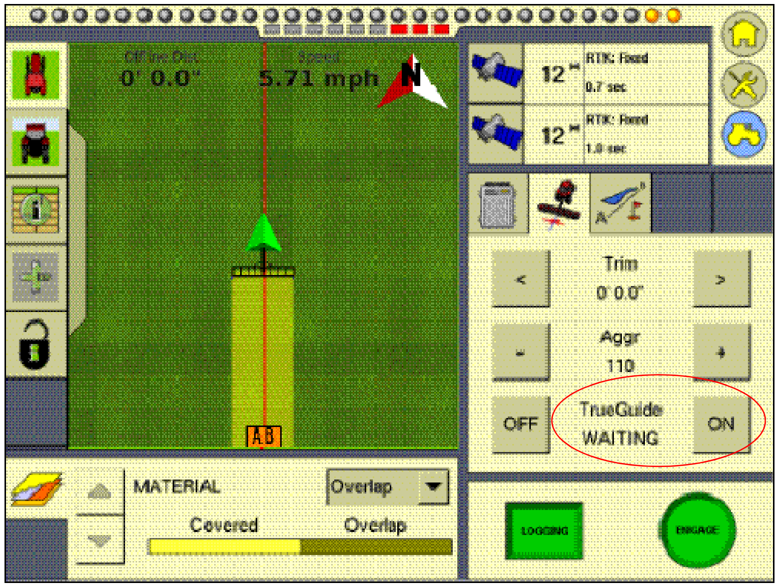
Operating the TrueGuide system

1. In the Run screen, with the *TrueGuide* tab showing, tap **AUTO**:



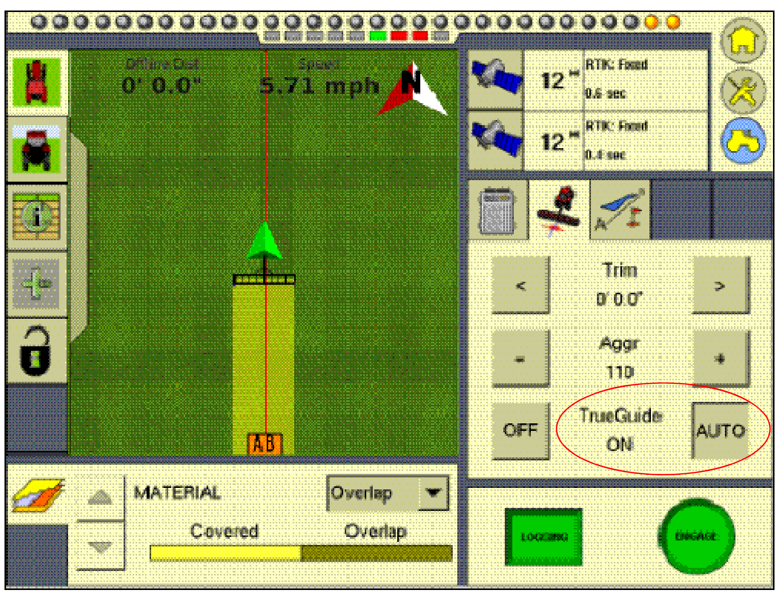
The TrueGuide system status is shown as Disengaged.

2. Tap **Engage** to start guidance. The **Auto** button changes to ON and the TrueGuide system status is shown as Waiting:



The Autopilot system acquires the line before transistioning to the TrueGuide system.

The TrueGuide system status remains at Waiting while the Autopilot system acquires the line. Once the TrueGuide system has taken control, the TrueGuide System status changes to ON and the TrueGuide system Engage button changes to Auto:



3. To disengage the TrueGuide system at any time, tap **Off**.

***Note** – To force the TrueGuide system to turn on when the status is Waiting, tap **ON** again.*

Note – *As soon as the TrueGuide system is disengaged, the Autopilot system immediately begins providing all guidance.*

TrueGuide system status indicators

The system status appears on the *TrueGuide* tab between the **Off / On (Auto)** buttons.

TrueGuide status	Description
Off	The TrueGuide system is off.
Disengaged	The TrueGuide system is ready, but not engaged.
Waiting	The Autopilot system is engaged, and the TrueGuide system is preparing to engage after a short pause.
On	The TrueGuide system has engaged and is on.

TrueGuide system aggressiveness settings

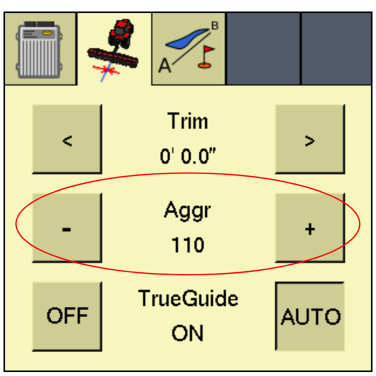
To set the default aggressiveness value, see Setting up the TrueGuide system, page 497.

- Increasing the aggressiveness increases the response to move the implement back to the guidance line.
- Decreasing aggressiveness smooths the response to the implement moving offline.

For...	Use as default...
Steep slopes (10%– +30%)	150%
Slow-speed applications	125%
Normal operation	100%
High-speed applications (>8 MPH)	33%

Adjusting aggressiveness during operation

1. From the Run screen, select the TrueGuide Plugin:



2. Do one of the following:
   – To increase aggressiveness, tap **+**.
   – To decrease aggressiveness, tap **-**.

CHAPTER

14

The TrueTracker Plugin

In this chapter:

- About the TrueTracker system
- Configuration
- Using the TrueTracker system

One of the FM-1000 integrated display features that can be unlocked is the TrueTracker implement steering system.

This chapter describes the TrueTracker system and how to configure it to steer implements more accurately.

About the TrueTracker system

The TrueTracker implement steering system is an upgrade for the Autopilot automated steering system. With the Autopilot system, the vehicle receives guidance and pulls the implement. When the TrueTracker system is added to the Autopilot system, the implement receives separate guidance and steering to increase accuracy.

The system comprises two parts:

- Additional hardware installed on the implement
- Additional FM-1000 integrated display software provided by the TrueTracker plugin

The TrueTracker system extends the sub-inch, year-to-year repeatable accuracy of the Autopilot automated steering system to the implement.

Terminology

The term ***implement steering*** refers to the ability to actively steer the implement that a vehicle is towing.

Normally, it is not possible to tell the exact location of the implement. When you use the FM-1000 integrated display with the Autopilot automated steering system for sub-inch accuracy, the GPS antenna and receiver are mounted on the vehicle, and it is the vehicle that is guided.

On flat ground the implement will probably be directly behind the vehicle, but in the following conditions the implement can pull (***draft***) to one side:

- On side slopes
- In variable soil conditions
- On curved guidance patterns

The stand-alone Autopilot automated steering system has no way to detect or correct for implement draft:

In these conditions, the draft distance can be significant enough to lose repeatability for successive field operations despite the ±25 mm (±1 inch) accuracy of the tractor equipped with the Autopilot system.

Benefits of the TrueTracker system

The TrueTracker implement steering system is an optional upgrade for the Autopilot system. You must unlock and install the second FM-1000 integrated display's internal receiver on the implement. Using the Trimble T3™ inertial terrain compensation technology and the accuracy of the receiver, the TrueTracker system can steer the implement, ensuring it remains online behind the vehicle even on extremely sloped ground.

The TrueTracker system supports the following:

- Steering in reverse
- Straight and curved guidance patterns
- Independent implement offset
- Independent aggressiveness control for the implement
- Zero steering to center the coulters

Requirements of the TrueTracker system

- An Autopilot system with the FM-1000 integrated display
- An unlock code for the FM-1000 integrated display implement steering functionality

Installing the TrueTracker system

The TrueTracker system requires professional installation. For more information, contact your local Trimble reseller.

Configuration

To configure the TrueTracker system, complete the following steps:

1. Activate the system. See page 506.
2. Configure the implement settings. See page 506.
3. Configure the implement controller. See page 510.
4. Configure the implement. See page 512.
5. Calibrate the implement. See page 513.

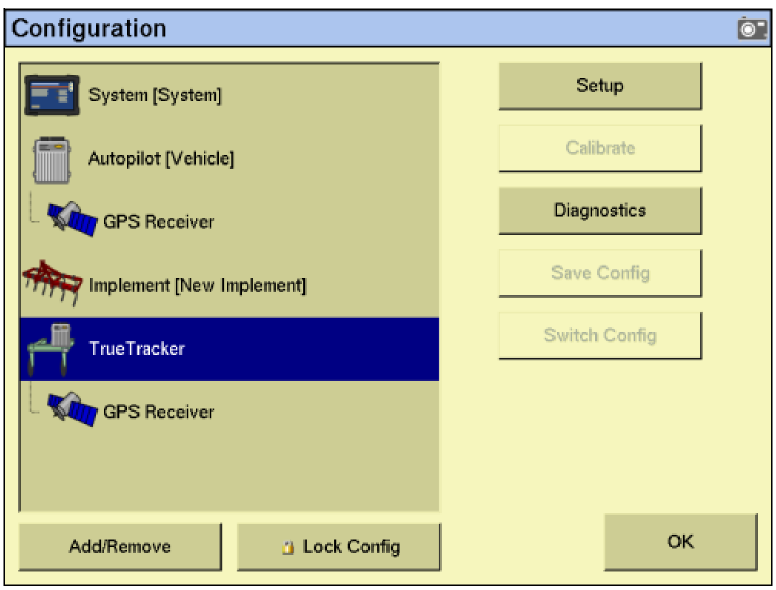
Activating the TrueTracker system

Before you can use the TrueTracker system, you must activate it on the FM-1000 integrated display. For step-by-step instructions, see Entering the password to activate a plugin, page 195.

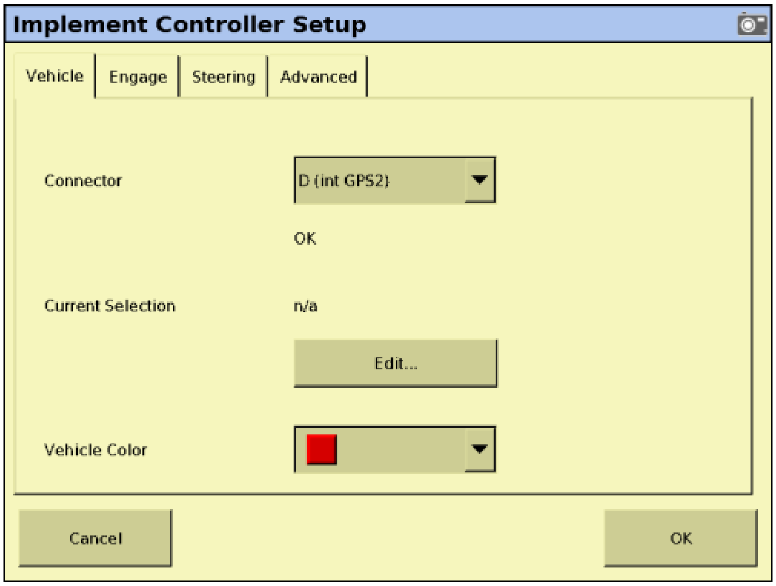
Note – *This process requires you to enter the activation password. If you do not have an activation password, contact your local Trimble reseller.*

Configuring the implement settings

1. From the Home screen, tap .
2. Tap the implement **Edit** button.
3. In the *Configuration Selection* screen, ensure that the Autopilot option and the TrueTracker plugin are both installed. See Adding or removing a plugin, page 194.
4. On the *Configuration* screen, select the TrueTracker plugin and then tap **Setup**:

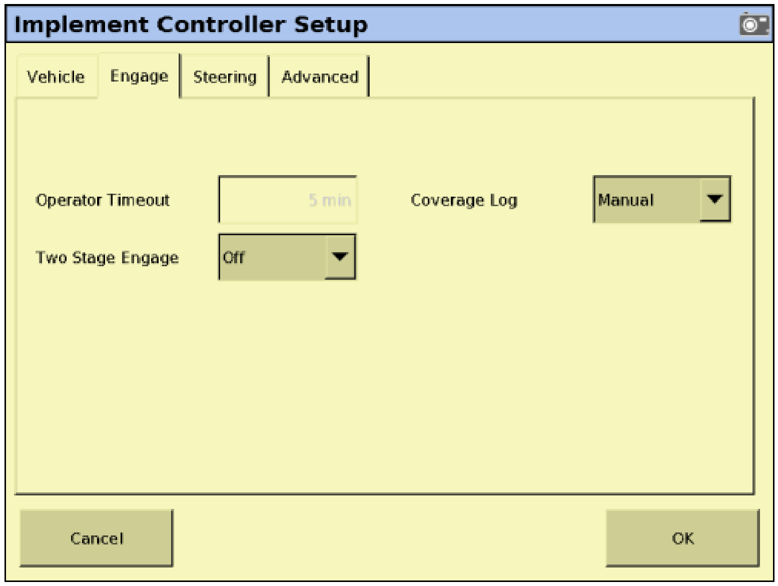


Configuring the Vehicle tab



1. From the *Connector* list, select the port that the TrueTracker implement controller is connected to.
2. For the *Current Selection* list, tap **Edit** to change the vehicle profile location and implement model, see Configuring the implement make and model, page 510.
3. From the *Vehicle Color* list, select the color you wish your vehicle to appear on the display screen.
4. Select the *Engage* tab.

Configuring the Engage tab



1. In the *Engage* tab, adjust the *Operator Alert Timeout* value.

   The alert appears if the operator does not respond within the defined period of time. If the operator still fails to respond, the vehicle begins to drive in a tight loop.

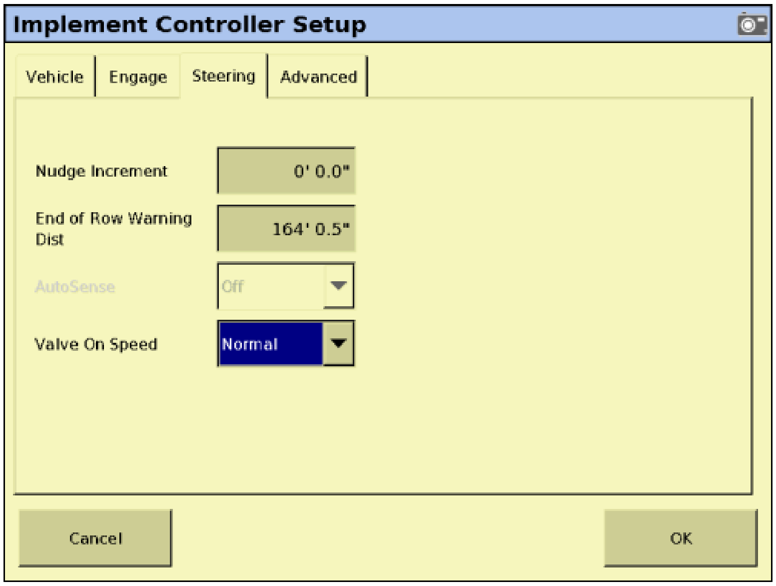
2. Set the *Two Stage Engage* status:

Item	Description
On	The **Engage** button requires multiple taps to engage: – The first tap engages implement steering – The second tap engages the vehicle steering – The third tap disengages both implement and vehicle steering
Off	The **Engage** button engages with one tap: – The first tap engages implement and vehicle steering – The second tap disengages both implement and vehicle steering

3. In the *Coverage Log* list, select either Manual or When Engaged.

4. Select the *Steering* tab.

Configuring the Steering tab



1. In the *Steering* tab, enter a value in the *Nudge Increment* field.

   Use this increment to set the amount by which the **Nudge** buttons move the line back to the correct path, or by which the **Trim** buttons move the vehicle position.

   The guidance line can move off target (requiring **Nudge**) as a result of:

   – GPS position drift when you return to the field for guidance, for example after you pause or turn off the system.

   – GPS satellite constellation changes as you drive in the field.

   The vehicle can steer offline (requiring **Trim**) as a result of:

   – Uneven drag on a vehicle from an unbalanced implement.

   – Uneven drag on a vehicle from soil conditions.

***Note** – The **Nudge** buttons become **Trim** buttons in RTK mode.*

2. Adjust the distance associated with the *End of Row* warning. (Longer vehicles that take longer to turn need an earlier warning and so a greater distance).

3. Set the *Valve On Speed*:

   – For vehicles that operate at normal speeds, select *Normal*.

   Additional settings are supported only with NavController II firmware versions 5.10 and later.

   – For vehicles operating at very slow speeds, select *Low* or *Ultra low*.

   Speed thresholds that you can select from the display are:

   – Normal > 0.4 m/s (1.3 ft/s)

   – Low > 0.1 m/s (0.3 ft/s)
   – Ultra low > 0.02 m/s (0.07 ft/s)

4. Tap **OK**.

Configuring the implement controller

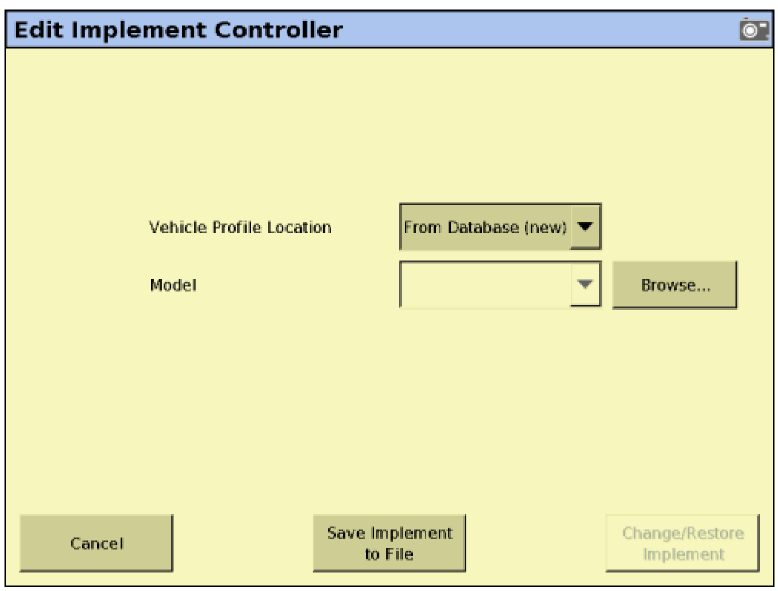
Your vehicle make and model were selected when your TrueTracker system was installed. If the details in the *Implement Controller Settings* group are correct, skip this step and go to Configuring the implement, page 512. Otherwise, configure the implement controller as described here.

***Note** – When you configure the implement make and model, the previous calibration settings are lost. If you will want to use the current vehicle settings again, save them before you proceed.*

Configuring the implement make and model

***Note** – In version 3.0 of the FM-1000 integrated display, the Vehicle Profile Location defaults to From Database (new).*

1. In the *Implement Controller Settings* group tap **Edit**:



2. Do one of the following:

- To select a new make and model from a database of vehicles (.vdb) on the FM-1000 integrated display CompactFlash card:

   a. In the *Vehicle Profile Location* list, select From Database (new).

   b. Tap **Browse**.

   c. Select the required .vdb file and then tap **Open**.

If you need to obtain a .vdb file, contact your local reseller.

- To select an existing vehicle from a previously saved file (.cfg) on the card:
  a. In the *Vehicle Profile Location* list, select From Saved File (existing).
  b. Tap **Browse**.
  c. Select the required file and then tap **Open**.

3. Tap **Change/Restore Implement**. The following message appears:

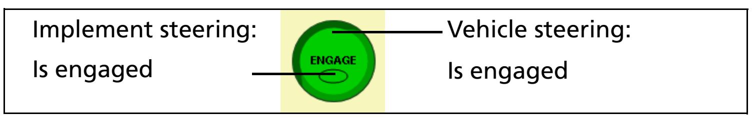
   The specified implement model will now be selected on the Autopilot controller. This will cause the Autopilot controller to be reset. Do you want to continue?

4. Tap **OK** to load the new configuration or tap **Cancel** to abort. The Autopilot Controller will now be reinitialized message appears.
5. Tap **OK**. After the Trained and qualified warnings have appeared the file is loaded.

Engage button

When implement steering is enabled, the Run screen **Engage** button changes state. It has two status indicators:

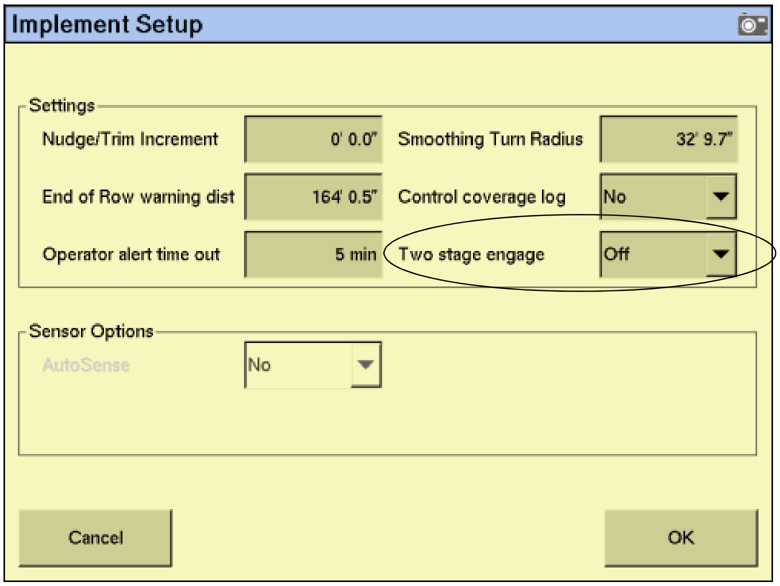
- The main button color, which represents vehicle steering.
- The small inner color, which represents implement steering.



Configuring the Engage button

You can set the **Engage** button to work in two different ways.

In the *Two stage engage* list, select the appropriate option:



Item	Description
On	The **Engage** button requires multiple taps to engage: – The first tap engages implement steering – The second tap engages the vehicle steering – The third tap disengages both implement and vehicle steering
Off	The **Engage** button engages with one tap: – The first tap engages implement and vehicle steering – The second tap disengages both implement and vehicle steering

Configuring the implement

Configure an implement so that the system can tell:

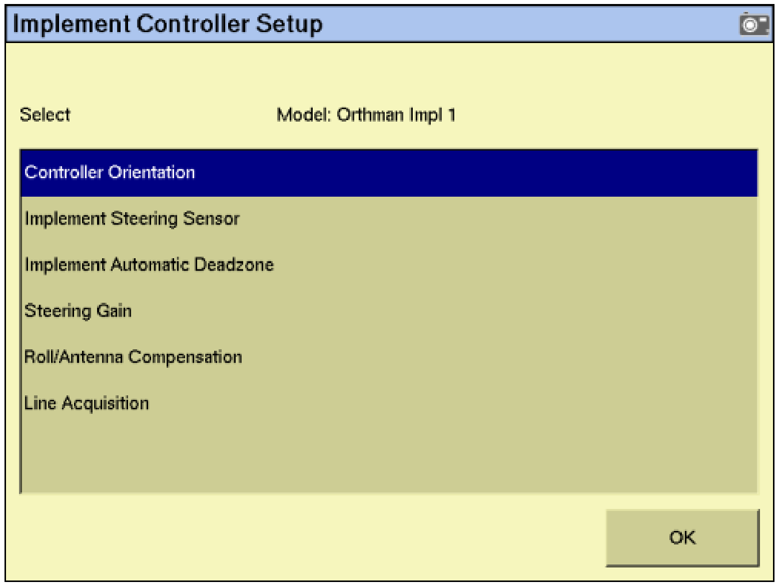
- which type of implement is attached
- how much area it covers
- how far it is offset

See Chapter 7, Implement Configuration.

***Note** – When you enter the number of implement sections, if the implement does not have sections, enter* **1**.

Calibrating the implement

1. From the *Configuration* screen, select the TrueTracker plugin and then tap **Calibrate**:



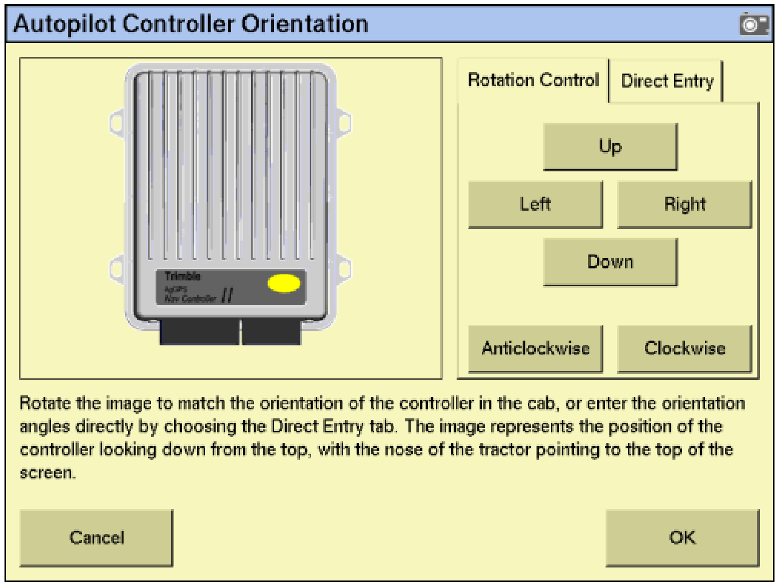
2. Select an item to configure and then tap **OK**.

3. Configure the selected item.

To configure...	See page...
Controller orientation	page 514
Steering sensor	page 514
Automated steering deadzone	page 515
Steering gain	page 517
Roll/antenna correction	page 522
Line acquisition	page 525

Configuring the controller orientation

1. Select the *Controller Orientation* option from the list:



   An image represents the current mounting orientation of the controller.

   The image is shown as though:

   – You are looking down on the vehicle from above.

   – The top of the screen points to the front of the vehicle.

2. Use the buttons to select the orientation of the controller.

   If the controller is set at a sloped angle, tap **Direct Entry** and then enter the yaw, pitch, and roll angles of the controller.

Note – *If you use the Direct Entry method to set custom angles, the on-screen image of the controller does not appear.*

3. Tap **OK** to accept the new orientation or tap **Cancel** to exit.

Calibrating the Implement Steering Sensor

Perform steering sensor calibration to convert the voltage output of the steering sensor into an equivalent steering angle measurement.

Note – *Complete this calibration* ***before*** *you attempt to calibrate the steering deadzone or roll correction procedures.*

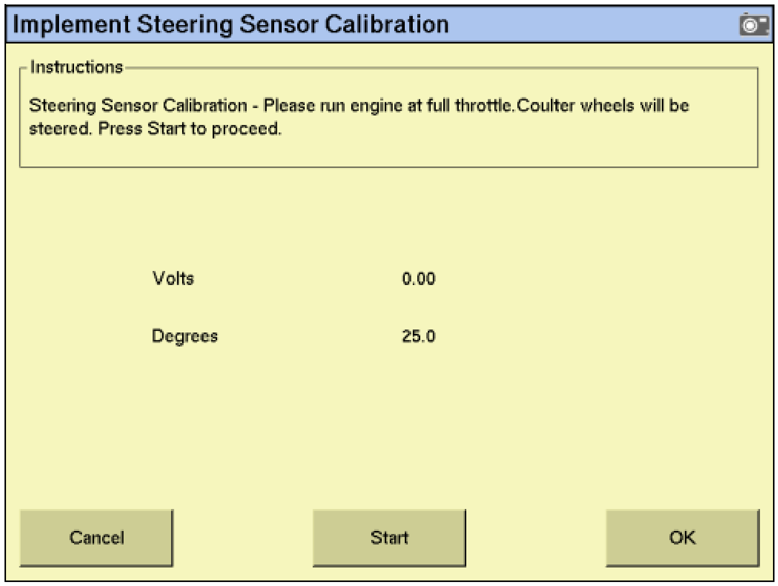
You must ensure that you:

- Perform this procedure on a level surface that is free of obstructions.
- Follow the instructions on each page.
- Run the engine at full throttle.

- Raise the implement.

To run the steering sensor calibration:

1. Select the *Steering Angle* procedure from the calibration list:



2. Tap **Start**.
3. Perform the calibration. The value in the *Volts* field is updated as the wheels are steered.

Calibrating the Implement Automatic Deadzone

The Implement Automatic Deadzone calibration procedure runs a series of tests on the valve and steering hydraulics to determine the point at which steering movement occurs.

WARNING – During the Implement Automatic Deadzone calibration, the system moves the wheels that steer the implement. To avoid injury, make sure that the area around the vehicle and implement is clear.

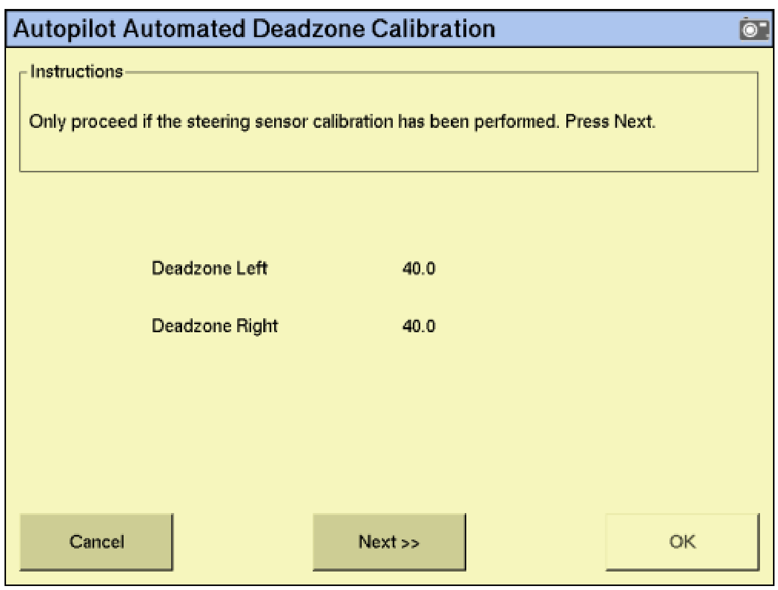
In this test, the system independently opens and closes each side of the steering system while determining the point at which wheel movement occurs.

Notes on calibrating the Implement Automatic Deadzone

- You must complete the Steering Angle procedure before you run this procedure. See Calibrating the steering angle sensor, page 130.
- To ensure optimal system performance, the hydraulic fluid must be at normal operating temperature when you run this procedure. On some vehicles with large reservoirs, it may take several hours for the fluid to reach operating level, especially if the implement circuit is lightly loaded. Consult the vehicle documentation to determine if the hydraulic fluid temperature can be shown on a vehicle console.
- If you perform the calibration while the system is still cold, repeat both the Deadzone and the Proportional gain calibration procedures once the system is at operating temperature.

To configure the automated steering deadzone:

1. Place the vehicle in an area that is free of hazards.
2. Raise the implement.
3. Select the Implement Automatic Deadzone procedure from the calibration list. See page 513.



4. Tap **Next** to continue. The second *Autopilot Automated Deadzone Calibration* screen appears.
5. Tap **Next** in the two screens that appear next.

***Note** – Read the onscreen instructions on each page.*

Follow the instructions. The system will automatically move the coulter wheels in both directions several times.

6. Tap **Start**. The system engages and performs the calibration.

Automated Deadzone error messages

If a calibration cycle is unable to complete successfully, one of the following error messages appears:

Message	Meaning
Error - Steering Close To End Stops	Before the calibration cycle could be completed, the measured steering angle approached the end stops. Retry, and if the problem persists, instead of centering the steering at the start of each cycle, try turning the steering in the opposite direction to that which is being tested so that the calibration procedure has a greater range to test over.
Error - Valve Connectors Could Be Swapped	The calibration test sensed the steering turning in the opposite direction to what was expected. Retry, and if the problem persists either the valve connectors have been accidentally swapped or the steering sensor calibration was performed incorrectly.
Error - No GPS	A GPS receiver must be connected and outputting positions before the software can run the calibration procedure.
Error - No Steering Response Detected	During the calibration cycle, insufficient movement was sensed in order for the calibration to complete. If the problem persists, the hydraulic installation could be faulty.
Error - Unable To Determine DZ: Try Again	A problem occurred when trying to compute dead zone. Retry, and if the problem persists, contact Technical Support.

Proportional steering gain calibration

Note – *Complete the steering sensor calibration* ***before*** *you perform the proportional gain calibration. Perform the proportional steering gain calibration* ***only*** *when the TrueTracker system performance is less than satisfactory.*

The proportional steering gain (PGain) setting enables you to reach a compromise between rapid steering response and stability. Modifications to the PGain setting affect two steering characteristics:

- *Slew Time*: The amount of time the steering coulters take to move from the far left to the far right position and vice versa.
- *Overshoot*: The percentage by which the steering coulters exceed the commanded angle before they settle on the correct value.

To correct slight variations caused by valve current response, friction, and hydraulic fluid viscosity, alter these settings.

High PGain values...	Low PGain values...
Decrease the slew time and increase the overshoot. This provides rapid responses, but can cause the steering to exhibit signs of instability (for example, a tendency to excessively overshoot).	Increase the slew time and decrease the overshoot. This improves the stability but can introduce significant delays in the steering response and can cause the vehicle to oscillate from side to side.

Notes on performing the proportional steering gain calibration

- Perform the Automatic Deadzone calibration immediately before you run the PGain calibration, even if the Automatic Deadzone calibration has been performed in the past.

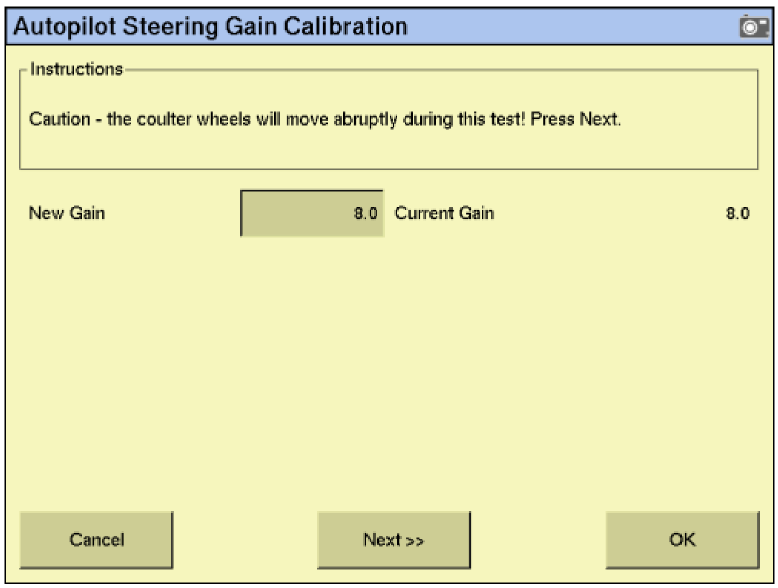
- Perform this calibration on a level surface, that is free of obstructions.
- Run the engine at full throttle.
- Raise the implement.

Increase the proportional gain up to the point just before any one of the following occurs:

- Slew times no longer decrease (a low value is required)
- Overshoot exceeds 10% (depending on the Tracker unit)
- Steering coulters noticeably shake near end stops

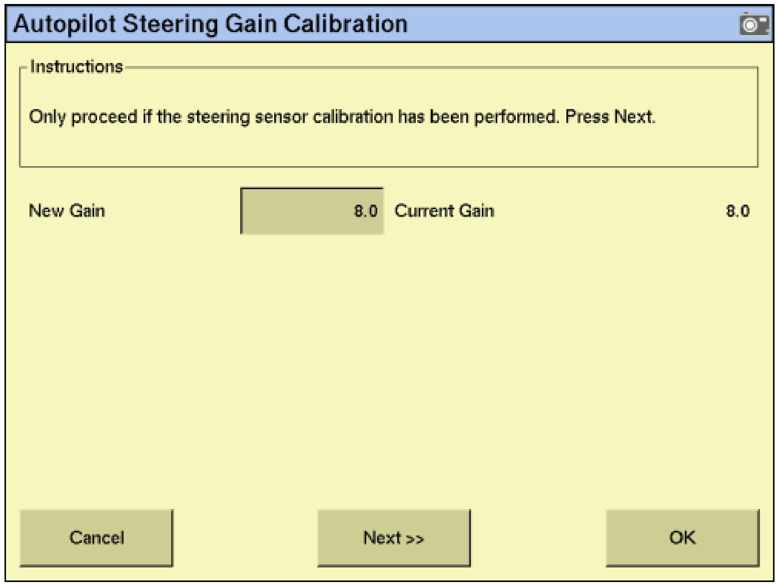
To calibrate the proportional steering gain:

1. Select the Steering Gain procedure from the calibration list:



2. Tap **Run Slew Test**. A warning message appears.

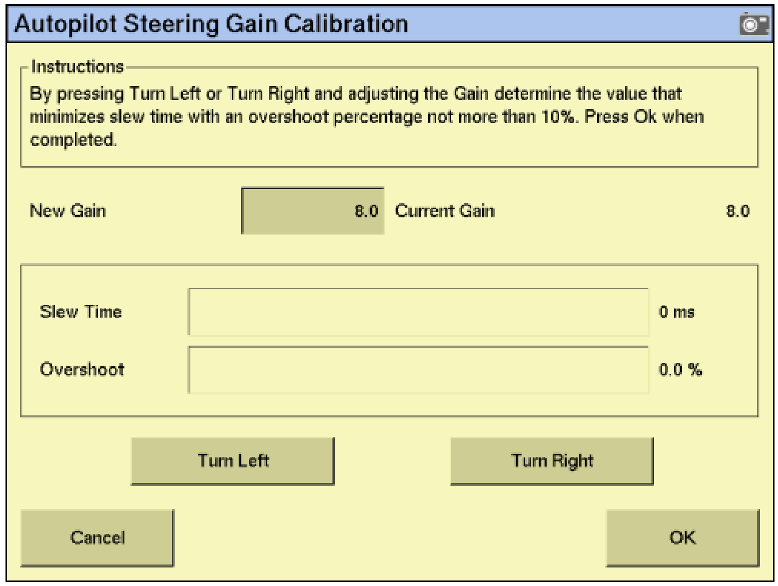
3. Tap **Next**:



CAUTION – The steering coulters can move abruptly during the Proportional Steering Gain procedure while the TrueTracker system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury. Be prepared for sudden steering coulter movements.

4. Tap **Next** in the two screens that appear next.
5. Test various gain settings while you monitor the implement steering performance and the values in the *Slew Time* and *Overshoot* fields for the Turn Left phase:
   a. Adjust the *New Gain* field (if required).

b. Tap **Turn Left**. Both turn buttons are unavailable while the wheels slew:

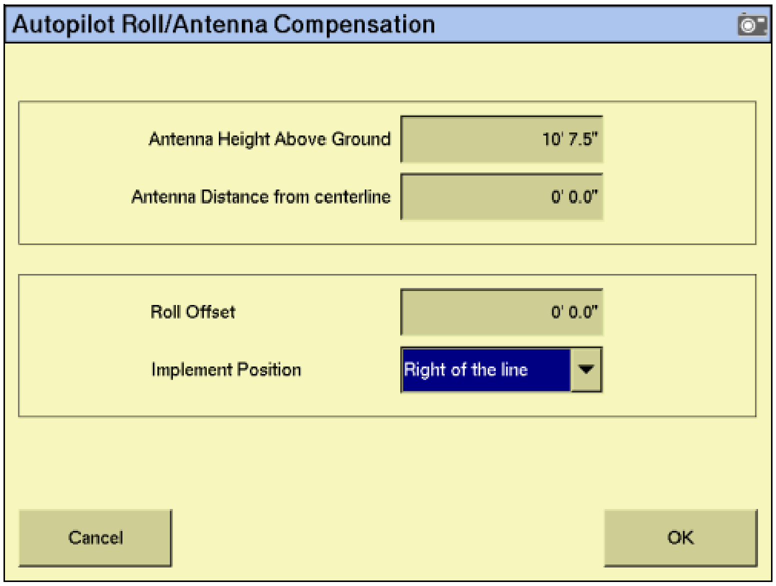


Note – *The optimum gain setting has short slew time (short millisecond reading) and overshoot percentage less than 10%.*

6. Repeat Step 5 with **Turn Right**. Both turn buttons are unavailable while the wheels slew.
7. When you locate the best gain value, do one of the following:
   - Tap **OK** to save the value in the Autopilot controller memory.
   - Tap **Cancel** to restart the calibration procedure.

Configuring the antenna position and roll offset correction

1. Select *Roll/Antenna Compensation* from the calibration list:



2. Before changing these settings, complete the procedures described below.

Notes on configuring the antenna position

- Before configuring the antenna compensation, make sure that:
  - the TrueTracker system is completely set up
  - the Autopilot software is properly configured
  - the correct GPS corrections are enabled

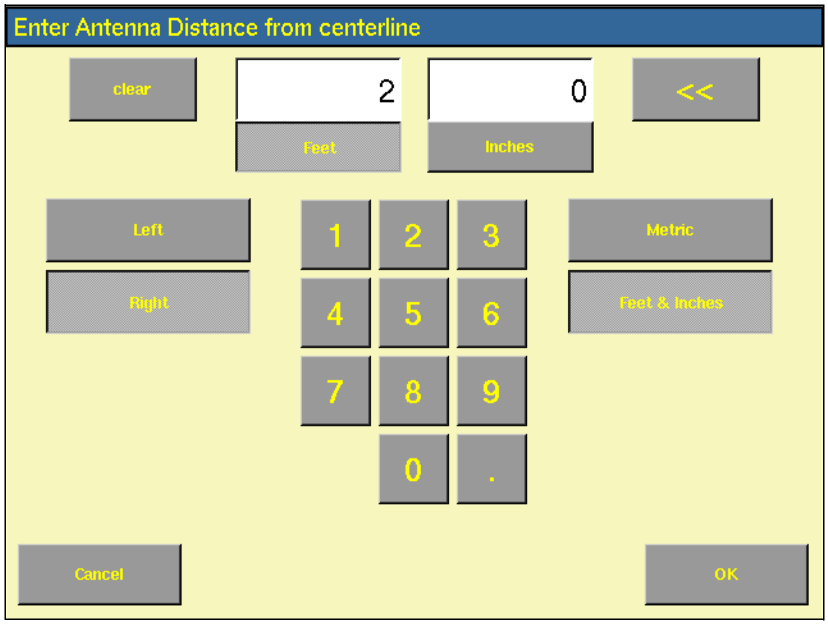
  Read this section carefully before you attempt the configuration.

Setting the antenna height above the ground

1. Place the tractor and implement on a flat, level surface.
2. Measure the distance from the ground to the base of the GPS receiver (or antenna).
3. Enter this value in the *Antenna Height Above Ground* field.

Setting the antenna distance from the center-line

1. Place the tractor and implement on a flat, level surface.
2. Measure the distance from the centerline of the implement to the center of the GPS receiver (or antenna):



3. Enter this value into the *Antenna Distance from centerline* field and indicate whether it is left or right of the centerline. Values to the left of the centerline are displayed as negative numbers. The nose of the vehicle is considered the forward direction.

Configuring the roll offset correction

Use one of the following methods to calculate the roll offset and then enter the roll offset correction to compensate for it:

- Coulter wheel track offset method
- Flag offset method

Choose the method that best matches the conditions.

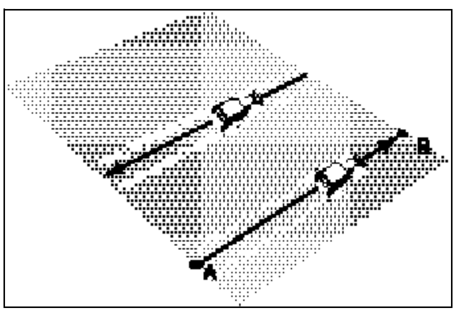
Calculating the roll offset: coulter wheel track offset method

1. Drive the tractor to a relatively flat field where tire impressions are visible and where you can complete passes of at least 400 m (1320 ft) in length.
2. Reset the roll offset value to 0 (zero).
3. Start a new field.
4. Create a straight AB Line.

5. Create a clean set of tire tracks in the field. To do this, start a new pass away from the area where the AB Line was created. When the system is stable, engage automatic steering mode and allow the Autopilot and TrueTracker systems to complete the pass.
6. At the end of the pass, turn the tractor around to return along the same pass from the opposite direction.
7. Engage automated steering mode and allow the system to complete the pass.
8. In the middle of the return pass, stop the tractor and confirm that the current position is directly on the AB Line. This ensures there is no cross track error.
9. Park the tractor and exit the cab. Evaluate the coulter wheel track pattern between the first and return paths.
10. Measure the difference between the track passes and record the distance. Also note whether the return pass is to the left or the right of the original pass. Record the results in Table 12 on page 524.

Note – *The offset should be consistently to the left or right.*

11. Repeat Step 5 through Step 10 two more times, for a total of three test runs. Use Table 12 on page 524 to record the offset distance and the left or right direction of offset for each test run.

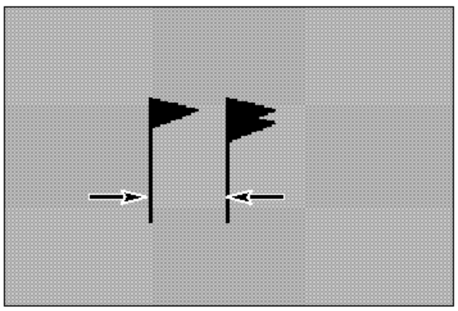


Calculating the roll offset: flag offset method

1. Drive the vehicle to a relatively flat area where you can complete passes that are at least 400 m (1320 ft) in length.
2. Reset the *Roll Offset* value to 0 (zero) on the *Roll Correction* screen. See Configuring the roll offset correction, page 522.
3. Start a new field.
4. Create a straight AB Line.
5. Start a new pass. Engage automatic steering mode when the system is stable. Stop the tractor midway through the pass. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
6. Park the vehicle and exit the cab. Insert a flag in the ground to mark the implement centerline for this pass.

7. Complete the pass. Turn the vehicle around to return along the same pass from the opposite direction.
8. Engage automatic steering mode. Stop the vehicle midway down the pass very close to the marker flag. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
9. Park the vehicle and exit the cab. Insert a second flag in the ground to mark the implement centerline for this pass. Note whether the second pass is to the left or the right of the first pass.
10. Measure the difference between the flags for the two passes and record the distance. Also record whether the return pass is to the left or the right of the original pass. Record the results in Table 12 on page 524.

Note – *The offset should be consistently to the left or right.*



11. Repeat Step 5 through Step 10 two more times for a total of three test runs. Use Table 12 on page 524 to record the offset distance and the left or right direction of offset for each test run.
12. Average the results of the three runs. (Total the offset distances from the three passes and divide by three). Use the following table for recording the roll correction results.

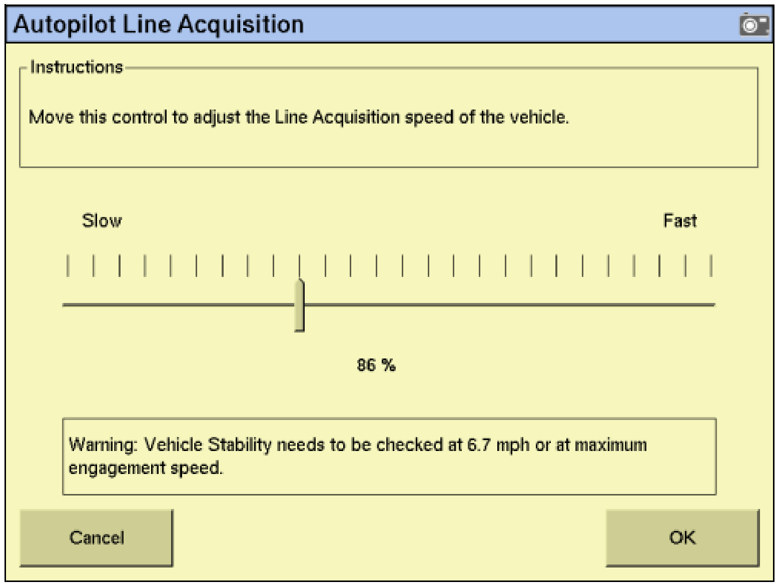
Test run	Offset distance	Offset direction
1		
2		
3		
	Total =	
	Total/3 = (Average offset value)	

Entering the roll offset

1. Enter the average offset value in the *Roll Offset* field. See Configuring the antenna position and roll offset correction, page 521.
2. Select one of the offline direction options, depending on whether the roll offset distance is to the left or right.

Calibrating the line acquisition aggressiveness

1. Select *Line Acquisition* from the calibration list:



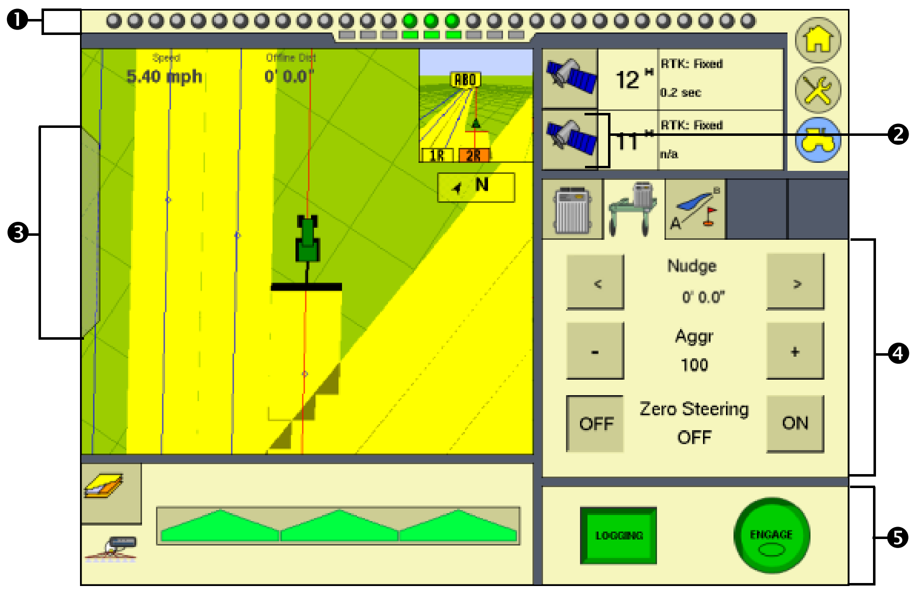
Adjust the line acquisition aggressiveness slider. The slider controls how aggressively the implement approaches the guidance line, using a scale from 50% to 150%. The optimal value for each profile is not necessarily 100%: it varies for different implement profiles.

Using the TrueTracker system

When you have configured the TrueTracker plugin, you can begin driving in the field with implement steering.

Main guidance screen

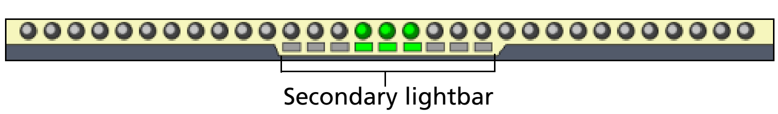
The FM-1000 integrated display's main guidance screen changes when implement steering is enabled.



Item	Description	See page...
❶	Implement lightbar	526
❷	Implement GPS information button	527
❸	Implement status text items (hidden)	527
❹	Implement tab	527
❺	Implement steering engage button	512

Implement lightbar

When implement steering is enabled, a second, smaller lightbar appears below the main lightbar:



This lightbar shows the implement guidance relative to the guidance line. Each LED on the second lightbar represents 1 inch.

Implement GPS information button

Tap the *implement GPS information* button  to view extra implement receiver status information. Tap **OK** to return to the Run screen.

Implement status text items

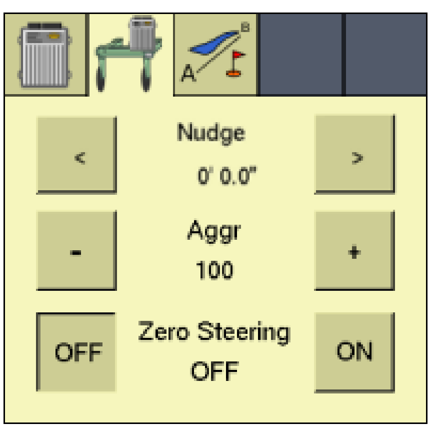
A number of status text items provide information about the implement. For more information, see Configuring the Status Items, page 88.

You can set these status text items to appear permanently at the top of the screen or on a slide-out tab. To view the following items, tap the corrections status button at the top right of the screen:

- Implement GPS Status
- Implement Correction Type
- Implement Correction Age
- Latitude
- Longitude
- Altitude
- Satellites
- HDOP
- VDOP
- Network ID

Implement tab

When the TrueTracker plugin is installed, the TrueTracker tab becomes available on the main Run screen:



The TrueTracker tab enables you to adjust the implement steering independently of the vehicle steering. For example, if you can see that the implement is consistently to one side of the guidance line but the vehicle is correctly online, you can apply Trim to the implement to correct it.

When turned on, Zero Steering commands the steering to zero degrees left/right, centering the steering device on the implement. This option can be turned on in the field, keeping the coulters pointed straight, or just at the ends of the field to center the steering.

Note – *Disengaging the TrueTracker system automatically turns off Zero Steering.*

Note – *If the implement is consistently offline, there may be a roll calibration issue. Recheck the roll calibration.*

Configuring the Engage button

You can configure the **Engage** button to work in two different ways:

Item	Description
Single press	The **Engage** button engages with one tap: – The first tap engages implement and vehicle steering – The second tap disengages automated steering
Two-stage press	The **Engage** button requires two taps to engage: – The first tap engages implement steering – The second tap engages the vehicle steering – The third tap disengages automated steering

To configure how the **Engage** button works, see Configuring the implement controller, page 510.

CHAPTER

15

The EZ-Boom Plugin

In this chapter:

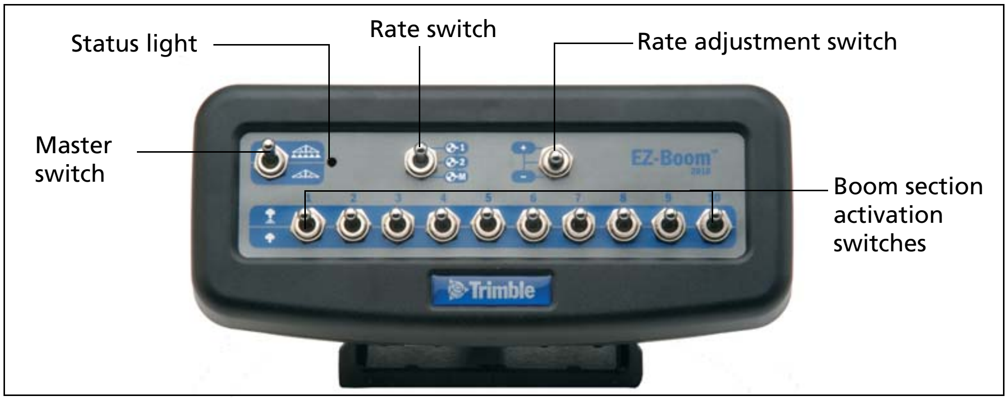
This chapter describes how to configure the EZ-Boom 2010 automated application control system to work with the FM-1000 integrated display to provide sprayer boom switching and rate control.

Note – *You can install only one variable rate control plug at once. You cannot run the Serial Rate Control plugin or the Tru Application Control plugin at the same time as the EZ-Boom plugin.*

EZ-Boom 2010 automated application control system

The EZ-Boom® 2010 automated application control system is a variable rate and automated boom switch controller. It enables you to control application rate sprayers, on either self-propelled vehicles or towed sprayers.

This figure shows the front panel of the EZ-Boom controller:



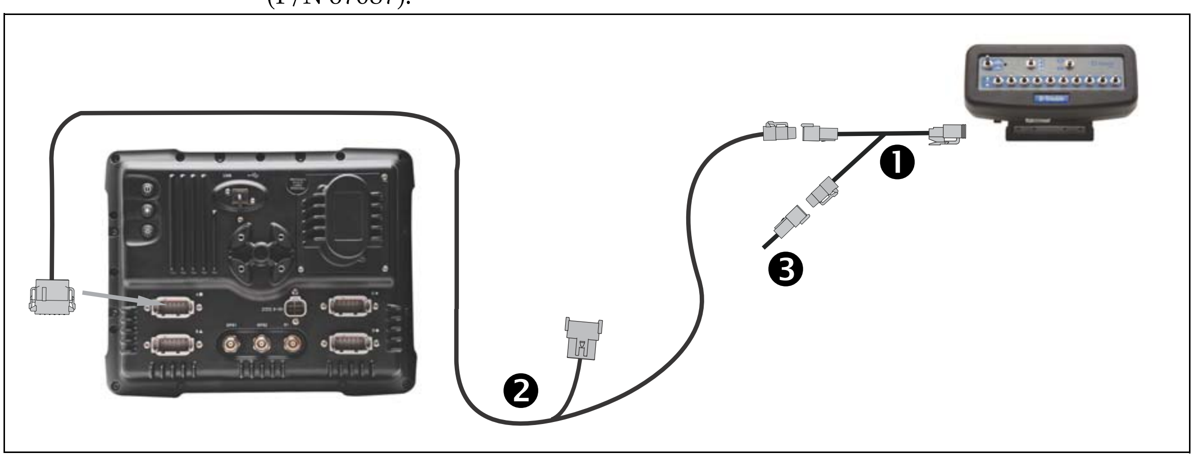
Installing the EZ-Boom controller

For information on installing the EZ-Boom controller, refer to the *EZ-Boom 2010 Automated Application Control System Getting Started Guide*.

Connecting the EZ-Boom system

To connect the EZ-Boom system to the FM-1000 integrated display:

1. Connect the FM-1000 integrated display.
2. Attach the EZ-Boom controller to the dash. Use the provided bracket.
3. Connect the EZ-Boom CAN cable ❶ (P/N 61437) to the Deutsch socket on the back of the EZ-Boom controller and then to the FM-1000 to CAN cable ❷ (P/N 67087).



4. Connect the FM-1000-to-CAN cable ❷ to port A on the FM-1000 integrated display.
5. Connect the terminator extension ❸ to the CAN extension.

***Note** – To unlock the FM-1000 integrated display to use the EZ-Boom controller for variable rate control, see Entering the password to activate a plugin, page 195.*

***Note** – If the EZ-Boom system is controlling sections only, and not rate, no passcode is required.*

Configuring the EZ-Boom system

To use the EZ-Boom controller to operate a spray boom and rate control, complete the following steps:

1. Enable the EZ-Boom plugin in the FM-1000 integrated display. See page 194
2. Configure the spray boom in the FM-1000 integrated display. See page 531.
3. Configure the EZ-Boom system settings. See page 532.
4. Calibrate the valve. See page 537.
5. Calibrate the flow meter. See page 538.
6. Calibrate the pressure sensor. See page 540.

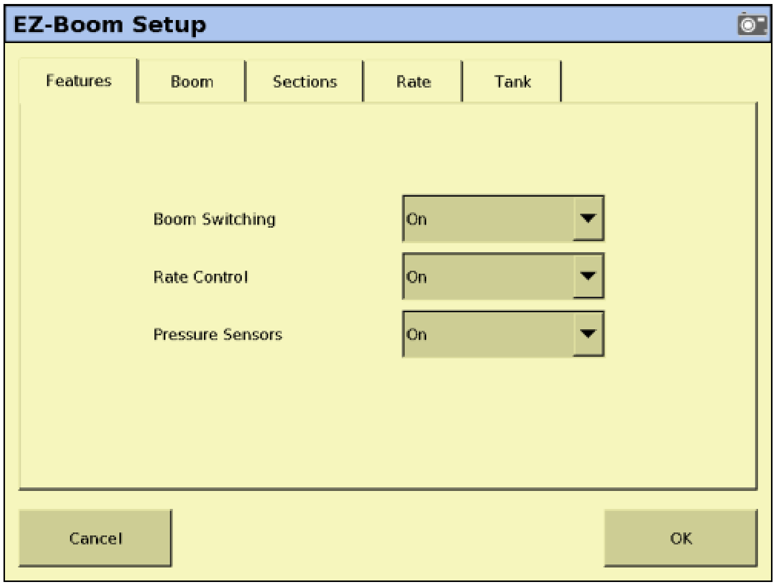
Configuring the spray boom (in the FM-1000 integrated display)

When you configure an implement with the EZ-Boom or the Tru Application Control plugin installed, additional options appear on the *Edit Implement* screen.

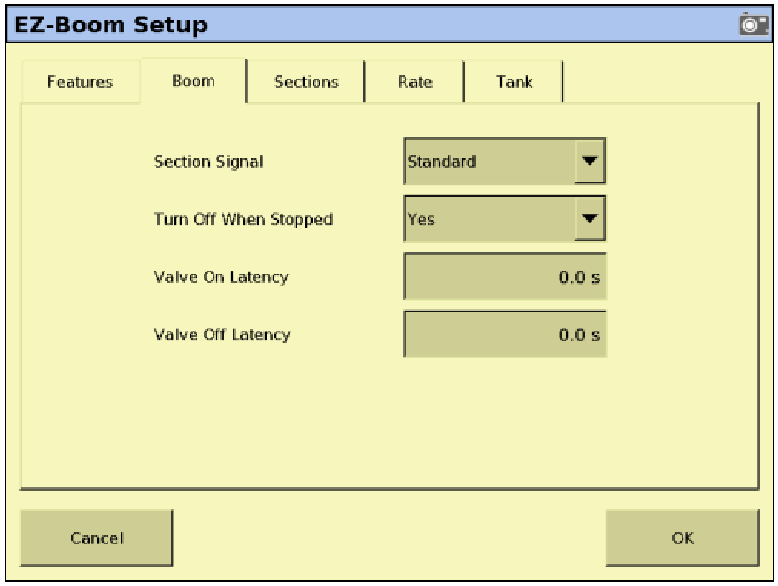
For more information on configuring the additional settings, see Configuring the Extras tab, page 188.

Configuring the EZ-Boom system settings

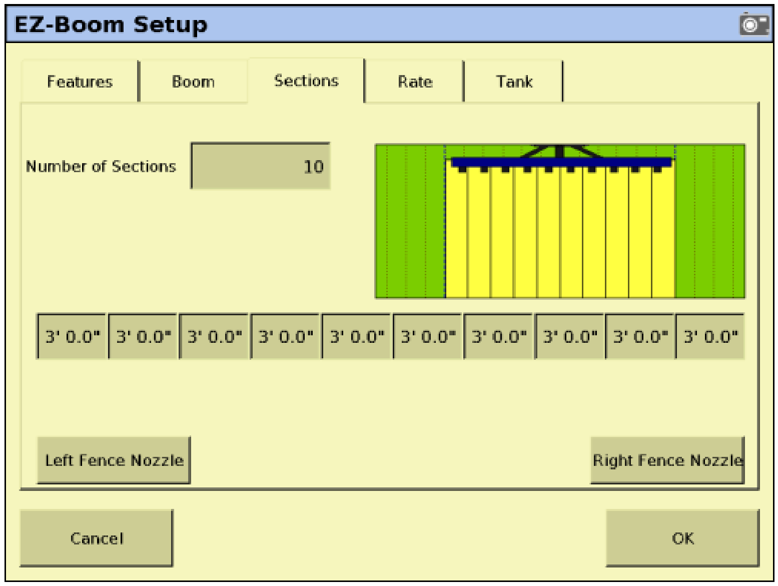
1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Setup**. The following *EZ-Boom Setup* screens appear. Set the options as required for each screen:



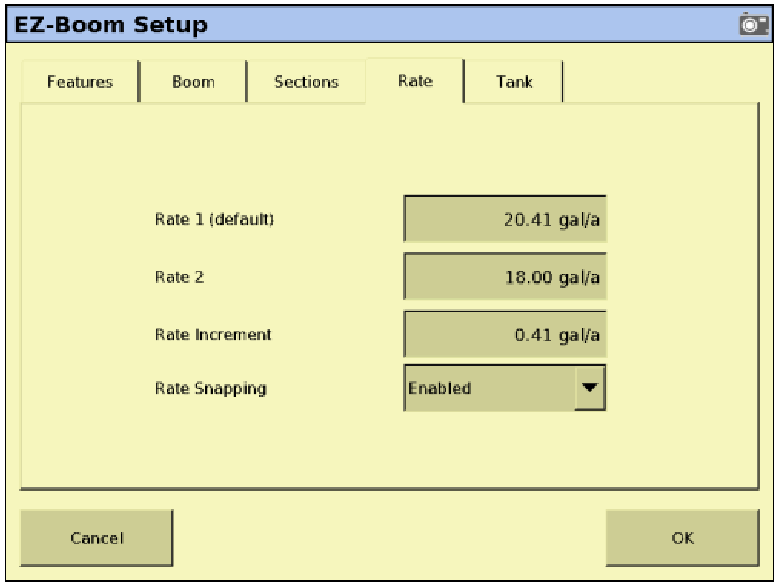
Features options	Description
Boom Switching	To turn off boom switching, set *Boom Switching* to Off. This lets you manually control the boom sections. To use automated boom switching, keep the *Boom Switching* set to On.
Rate Control	To turn off rate control, set *Rate Control* to Off. Use this option for section control only, or to use another controller for rate control. To use the EZ-Boom for *Rate Control* select Yes.
Pressure Sensors	You can connect up to 2 pressure sensor to be viewed on the display.



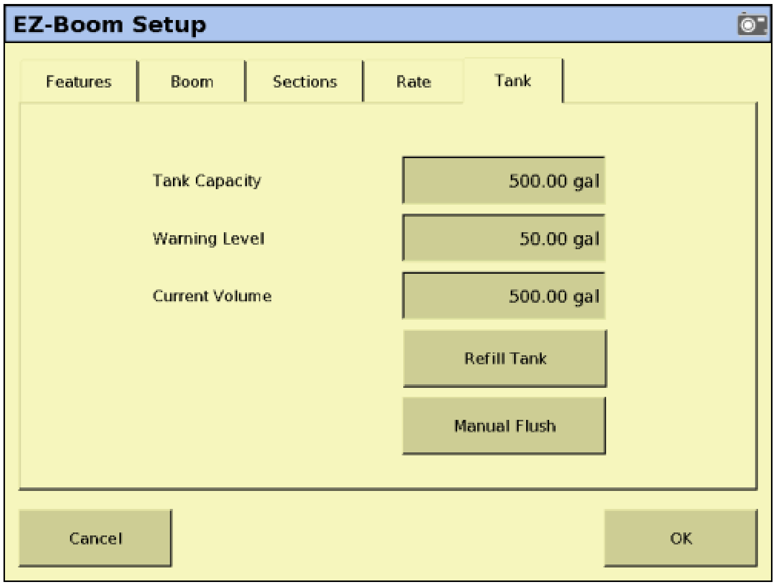
Boom options	**Description**
Section Signal	Select Standard (Sprayer) for normal operation, and Inverted (Tru Count) when running Tru Count clutches without an inverter box. *Note: If running Tru Count with an inverter box you will use the Standard setting.*
Turn Off When Stopped	If the vehicle is a clutch-operated planter, set this option to No so that you can continue planting even when the vehicle is stopped. Otherwise, select Yes.
Valve On Latency	There can be a delay between the time when you send a command to the sprayer and the time when it begins spraying. Set the *Valve On Latency* setting to the number of seconds that the system takes to respond when a command is sent.
Valve Off Latency	There can be a delay between the time when you send a command to the sprayer and the time when it ends spraying. Set the *Valve Off Latency* setting to the number of seconds that the system takes to respond when a command is sent.



Boom options	Description
Number of Sections	The number of main sections that your are running, not including Fence Nozzles.
Section widths	The section widths can be individually set, but they have to equal the Swath Width value set during the implement setup.
Fence Nozzles	If the vehicle is equipped with fence nozzles controlled by the EZ-Boom system, you can add Left, Right, or Both. *Note: The Fence Nozzles being enabled will decrease the number of main sections you can have. For example, if you enable both fence nozzles you can only have 8 main sections instead of 10.*



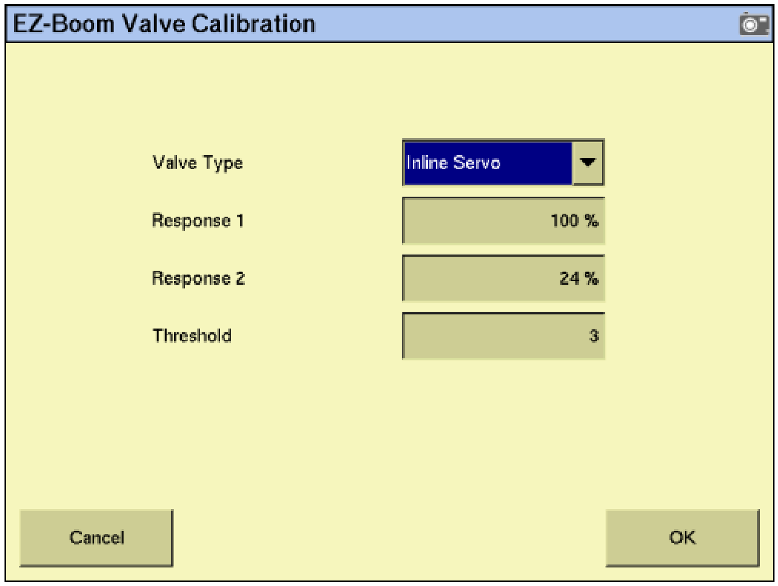
Rate options	Description
Rate1 (default)	This is the volume that the sprayer supplies when the Rate switch is set to 1.
Rate2	This is the volume that the sprayer supplies when the Rate switch is set to 2.
Rate Increment	When the Rate switch is in the Rate 1 or Rate 2 position, the current application rate increases or decreases by this amount each time you tap the Rate adjustment (inc/dec) switch.
Rate Snapping	In the *Rate Snapping* list, select an option: – Enabled to show the applied rate the same as the target rate, if the applied rate is within 10% of the target rate. – Disabled to show the actual applied value.



Tank options	**Description**
Tank Capacity	The capacity of the tank when full.
Warning Level	A warning appears when the calculated solution level reaches this point.
Current Volume	The amount of solution that is currently in the tank. ***Note –*** *To do a partial refill, just add the amount to the Current Volume.*
Refill Tank	This resets the *Current Volume* value to the *Tank Capacity* value.
Manual Flush	Pushes solution through the system at the maximum rate. The tank flushes until it is empty or you stop it.

Calibrating the valve

1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Calibrate**. The *Implement Calibration* screen appears.
2. Tap *Valve Calibration*:



3. Select the valve type from the drop-down list:
   - Inline Servo
   - Bypass Servo
   - Pump PWM
   - Pump Servo
   - Pump PWM Ground
   - HARDI % Bypass
   - None

Note – *If you have an existing Raven bypass servo system, it may be wired so that the valve open and close commands are reversed. The EZ-Boom controller reverses the commands in the software. Either select Inline Servo, or rewire the valve. Some systems have a short crossover cable, which can be removed to correct the issue.*

4. If you selected Inline, Bypass, or Pump Servo, enter values in the three fields in the *Servo* group.

Item	Description
Response 1 (%)	The responsiveness of the valve when the application rate is far away from the target rate.
Response 2 (%)	The responsiveness of the valve when the application rate is close to the target rate.
Response Threshold	This ratio is the point at which the application rate is close enough to the target rate for the responsiveness of the valve to switch from *Valve Response 1* to *Valve Response 2*.

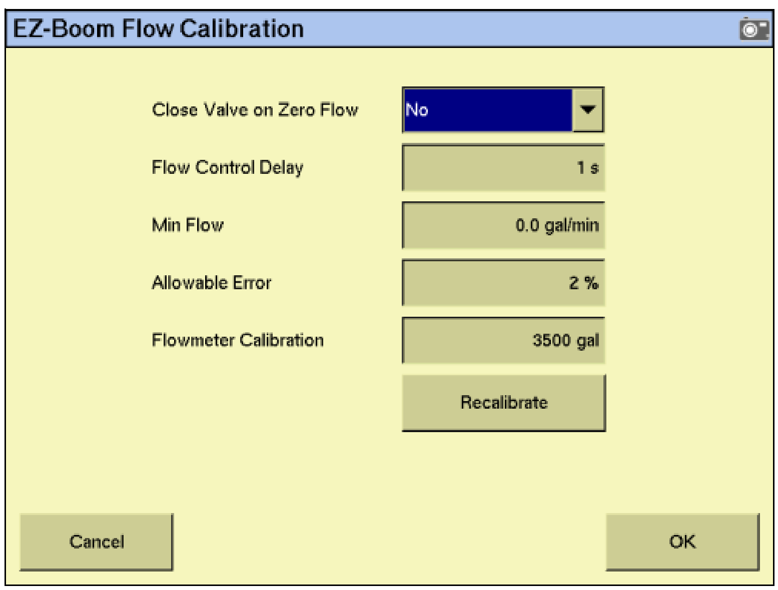
If you selected Pump PWM or Pump PWM Ground, enter values in the three fields in the *PWM* group:

Item	Description
Zero Flow Offset (%)	The shut-off point of the valve.
Frequency (Hz)	The operating frequency of the valve.
Gain	The sensitivity of the valve.

5. Tap **OK** to return to the *Implement Calibration* screen.

Step 4: Calibrating the flow meter

1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Calibrate**. The *Implement Calibration* screen that appears contains the following options:
   - Flow Calibration
   - Valve Calibration
   - Pressure Calibration
2. Tap *Flow Calibration*:



3. From the *Close Valve on Zero Flow* drop-down list, select *Yes* or *No*:

Setting	Description
Yes	The valve closes when all the boom sections are closed.
No	The valve remain in its current position when all the boom sections are closed.

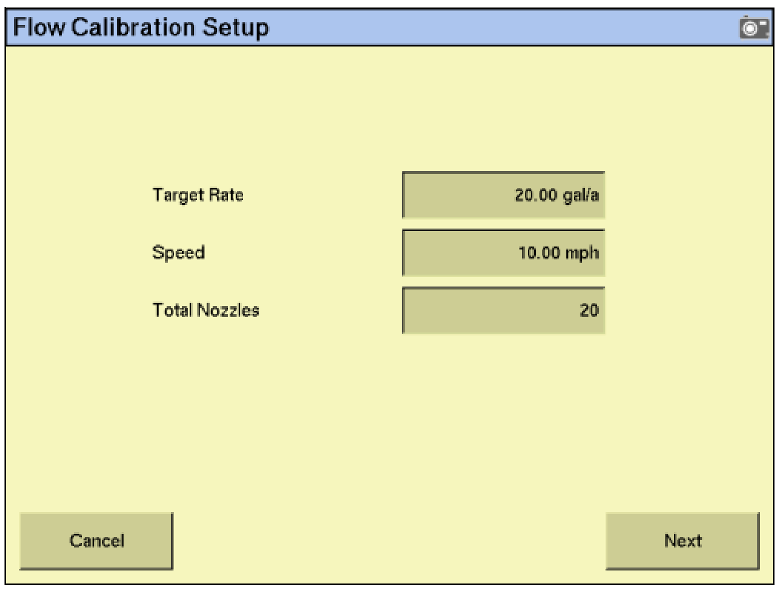
4. Enter values in the four fields:

Item	Description
Flow Control Delay (s)	How long it takes the system to change rates.
Min Flow (gpm)	The lowest flow rate that the system will allow. If this point is reached, a warning message appears and the flow control valve will not close any further.
Allowable Error (%)	The level of allowable Rate 1 or Rate 2 error before the control valve adjusts.
Flowmeter Calibration	– For a Raven flowmeter, enter the number printed on the flowmeter. – For other makes of flowmeter, multiply the number printed on the flowmeter by 10 and then enter it (for example, if the number on the flowmeter is 75 pulses/gallon, enter 750).

The number printed on the flow meter is a starting point. For correct performance and accuracy, a flow meter calibration is required.

To run the flowmeter calibration:

1. Tap **Recalibrate**:



2. Set the *Target Rate* field to your normal operating rate.
3. Set the *Speed* field to your normal operating speed.
4. In the *Total Nozzles* field, enter the total number of nozzles on the spray boom. Do not include any fence nozzles in the nozzle count. (Fence nozzles are nozzles at the far left or right of the boom that point out to the side.)
5. Tap **Next**. The *Flow Calibration Test* screen appears.
6. On the EZ-Boom controller, set the rate switch to Rate 1.

   The test requires using a measuring device (for example, a calibration jug) to collect the flow for one minute. To achieve a more accurate result for the spray boom, collect the flow from at least three nozzles by moving the measuring device from one nozzle to the next during the test.

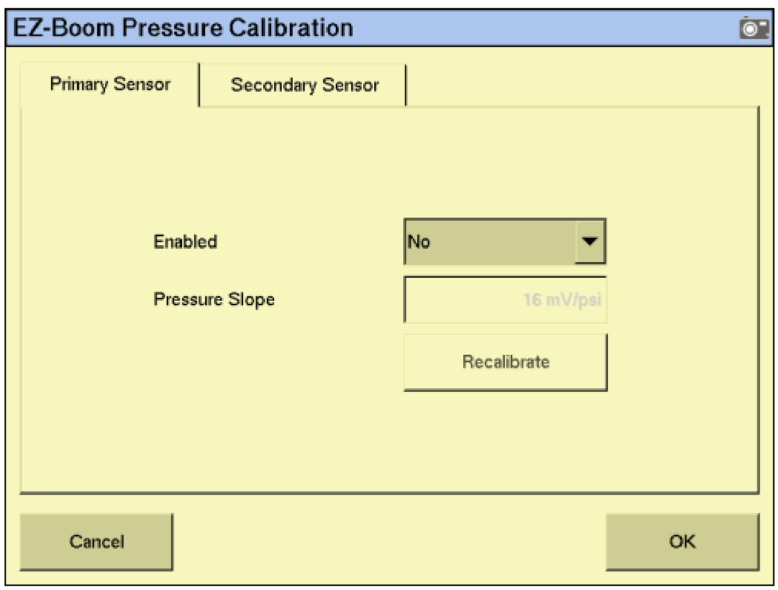
7. Tap **Start Flow** to begin the test.
8. Collect the sample volume for one minute.

***Note** – You can collect for any length of time you like. A longer sample may produce a more accurate result. However, you must then divide the result to determine the volume per minute.*

9. After one minute, stop collecting. Tap **Stop Flow**.
10. Tap **Next**. The *Flow Calibration Result* screen appears.
11. Tap the *Measured Flow/Nozzle* field. The *Enter Measured Flow/Nozzle for Calibration* screen appears.
12. Select the units and then enter the collected volume. Tap **OK** twice.

Calibrating the pressure sensor

1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Calibrate**. The *Implement Calibration* screen appears.
2. Tap *Pressure Calibration*:



3. In the *Use Pressure Sensor* drop-down list, select the following, as required:
   – If your system does not have a pressure sensor, set both the Enabled options to *No*. The pressure sensor calibration is complete.
   – If your system has only a primary pressure sensor, set the Enabled option in the *Primary Sensor* group to *Yes* and the Enabled option in the *Secondary Sensor* group to *No*.
   – If your system has two pressure sensors, set both Enabled options to *Yes*.

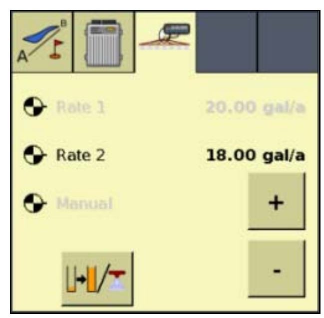
   If you selected Yes for the *Enabled* option in the Primary Sensor group, the **Recalibrate** button becomes available.

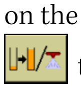
4. Tap the *Pressure Slope* field in the *Primary Sensor* group to enter the value. The pressure slope is the relationship between pressure and the output of the sensor. Trimble recommends the default of 16mV/psi for a Raven pressure sensor.
5. If you enabled the secondary sensor, tap the *Pressure Slope* field in the *Secondary Sensor* group to enter the value. Trimble recommends the default of 16mV/psi for a Raven pressure sensor.
6. Tap **Recalibrate** in either group to run the pressure calibration sequence. The *EZ-Boom Pressure Calibration* screen appears. See below.

Pressure calibration sequence

1. Read the pressure off the pressure gauge.
2. Enter the pressure value in the *Actual Pressure* field.
3. Tap **Send Calibration**. The screen updates to show the current pressure.
4. Tap **OK**.

EZ-Boom tab



- The *EZ-Boom* tab on the Run screen shows your Rate 1, Rate 2, and Manual rates. The rate that is currently active is animated.
- The **+** and **–** buttons enable you to manually increase or decrease the flow. These function the same way as the Rate Adjustment (Inc/Dec) switch on the EZ-Boom controller.
-  takes you to the *Tank* tab for Refill.

Setting up the EZ-Boom system for automatic section control only

To disable the variable rate control of the EZ-Boom system (and just use the automatic boom-switching function):

1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Calibrate**. The *Implement Calibration* screen appears.
2. Tap *Valve Calibration*. The *EZ-Boom Valve Calibration* screen appears.
3. From the *Valve Type* drop-down list, select *None*.

4. Tap **OK**.

Additional information about the EZ-Boom system

Varying the active boom sections

Some variable rate controllers report to the FM-1000 integrated display which boom sections are active at any given time. For these controllers, the width of the coverage polygons displayed on the Run screen vary according to the currently-active boom sections.

The coverage polygons that are logged to the coverage Shape file are identical to those shown on screen; that is, the logged coverage width is also varied according to the active boom sections.

Note – *When you use a variable rate controller and you are logging, the FM-1000 integrated display shows the active boom width. This may result in nothing being shown if all boom sections are off.*

Limitations

Since not all controllers can provide information on the active boom sections, the width and placement of the coverage depends on what information is available:

- If the controller provides no information on the active boom sections, then the coverage width is the *Application Width* as defined in the *Implement Setup* screen.
- If the controller provides information on the total active boom width, but not which boom sections are on or off, the coverage width is also the *Application Width*.
- If the controller provides both active width and offset information, this is reflected accurately in the coverage drawing.

If you have a non-Trimble variable rate controller with a central boom section that is turned off, and boom sections remain on either side of this central section, this is not reflected in the coverage logging.

Logging variable rate data

Data describing the status of various variable rate parameters is logged to ESRI shape-files. Positions and associated data are logged at 5 Hz. The FM-1000 integrated display logs an average for each polygon, the size of which changes based on a number of tests.

When all boom sections are off, logging is stopped.

Data is recorded in metric units.

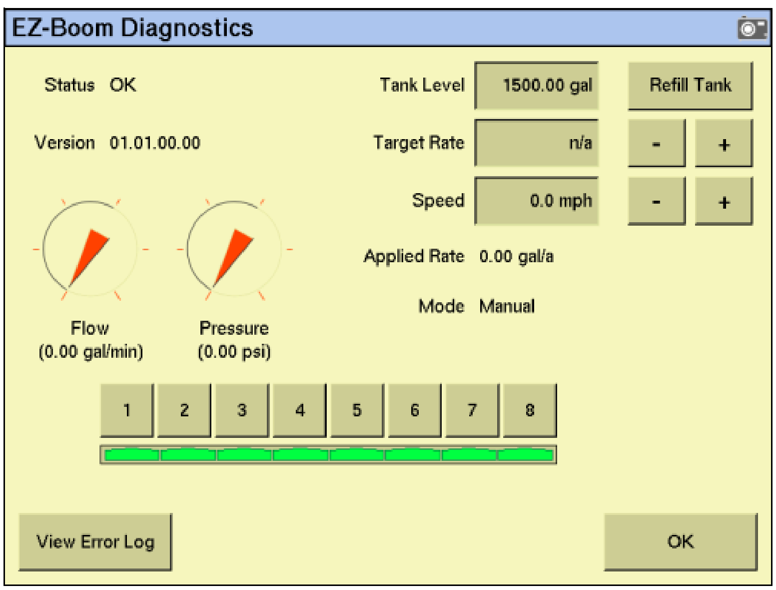
Column	Field description
Version	Coverage attribute file version
GPS_Status	Numeric GPS status value
Status_Txt	GPS status description

Column	Field description
Swath	The current swath number when coverage was recorded
Height	Height in meters
DateClosed	Date the polygon was closed
TimeClosed	Time the polygon was closed
Applied_Rate	Applied rate reported by the variable rate controller
Material	The material being applied
Material_ID	An index number related to the material

EZ-Boom system implement diagnostics

When an EZ-Boom system is connected, you can view EZ-Boom system diagnostic information:

1. From the *Configuration* screen, select the EZ-Boom plugin and then tap **Diagnostics**:



The *EZ-Boom Diagnostics* screen includes information on:

- current flow
- current pressure
- boom valve state
- EZ-Boom controller version number

It also shows the status of the EZ-Boom controller to ensure that it is working as expected.

To check that the system is responding as expected, set the *Target Rate* and *Speed* fields to a fixed known value.

To view previous errors, tap **View Error Log**.

Controlling an application device with the EZ-Boom controller

You can use the EZ-Boom controller to control an application device (a planter, liquid spreader, or Tru Count Air Clutch). This enables you to:

- use automatic boom switching to automatically turn individual seed boxes off and on
- use the EZ-Boom controller switches to manually turn individual seed boxes off and on

For more information, see Chapter 11, The Tru Application Control Plugin.

Updating the firmware on the EZ-Boom controller

See the *FM-1000 integrated display User Guide*.

CHAPTER

16

The Serial Rate Control Plugin

In this chapter:

- Non-Trimble variable rate controllers
- Additional information for non-Trimble variable rate controllers

The FM-1000 integrated display can be connected to third-party variable rate controllers manufactured by Flex Air, Raven, Rawson, New Leader, MID-TECH, and Hardi 5500.

This chapter describes how to configure the display for use with these rate controllers.

Note – *You can install only one variable rate control plug at once. You cannot run the EZ-Boom plugin or the Tru Application Control plugin at the same time as the Serial Rate Control plugin.*

Non-Trimble variable rate controllers

The FM-1000 integrated display supports the following non-Trimble variable rate controllers:

Make	Model	See page…
Raven	SCS 440, 440DB, 450, 450DB, 460, 660, 661, 700, 710, 750, 760	page 549
Rawson	Accu-Plant and Accu-Rate	page 550
New Leader	Mark III and Mark IV	page 550
Hardi	5500	page 552
Tyler	Flex-Air	page 552

The FM-1000 integrated display can send control signals to vary only one channel at a time.

***Note** – Before you can make any changes, you must close all fields.*

To use a non-Trimble variable rate controller to operate a spray boom, do the following:

1. Install the non-Trimble variable rate controller. See page page 546.
2. Enable the Serial Rate Control plugin. See page page 547.
3. Select the port for the variable rate controller. See page 547.
4. Configure the spray boom in the FM-1000 integrated display. See page page 547.
5. Enable and configure the variable rate controller in the FM-1000 integrated display. See page page 547.
6. Configure the variable rate controller. See page page 548.
7. Set any other features of the variable rate controller. See page page 552.

Installing a non-Trimble variable rate controller

Use the hardware provided with your variable rate controller to mount it in the vehicle cab.

To use a variable rate controller, you must connect it to port D of the FM-1000 integrated display using the connection cable (P/N 67091) and the associated cable for the supported controller. Your controller may need a special adaptor cable to work correctly. If so, contact your local Trimble reseller.

Most controllers also need to be configured to accept input data from the FM-1000 integrated display. For additional instructions, see the following section for your controller.

***Note** – Always make sure that the serial port connector is in place with screws firmly tightened (if available).*

Enabling the Serial Rate Control plugin

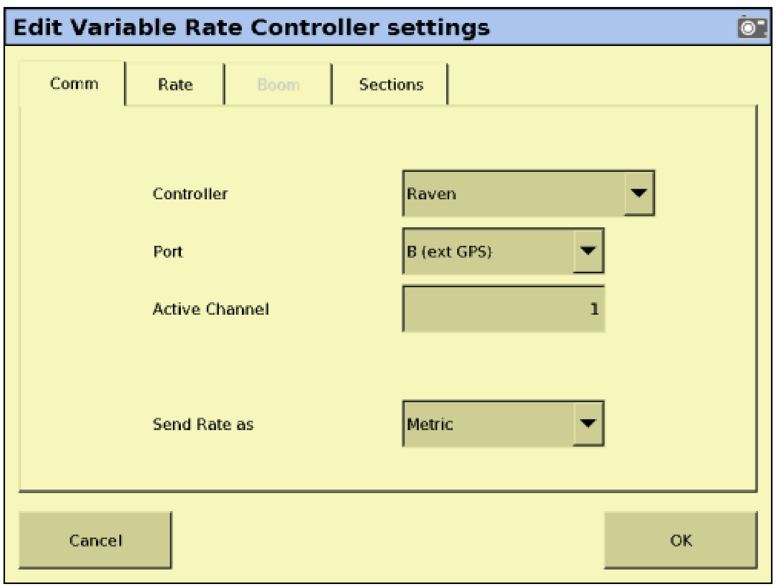
For instructions on installing the Serial Rate Control plugin, see Entering the password to activate a plugin, page 195.

Configuring the spray boom in the FM-1000 integrated display

Configure the spray boom as described in Chapter 7, Implement Configuration.

Enabling and configuring the variable rate controller (in the FM-1000 integrated display)

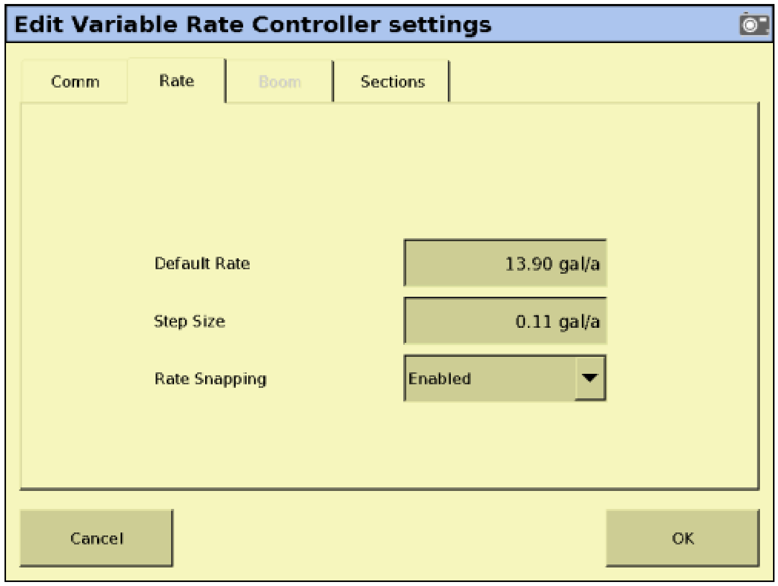
1. From the *Configuration* screen, select the Serial Rate Control plugin and then tap **Setup**:



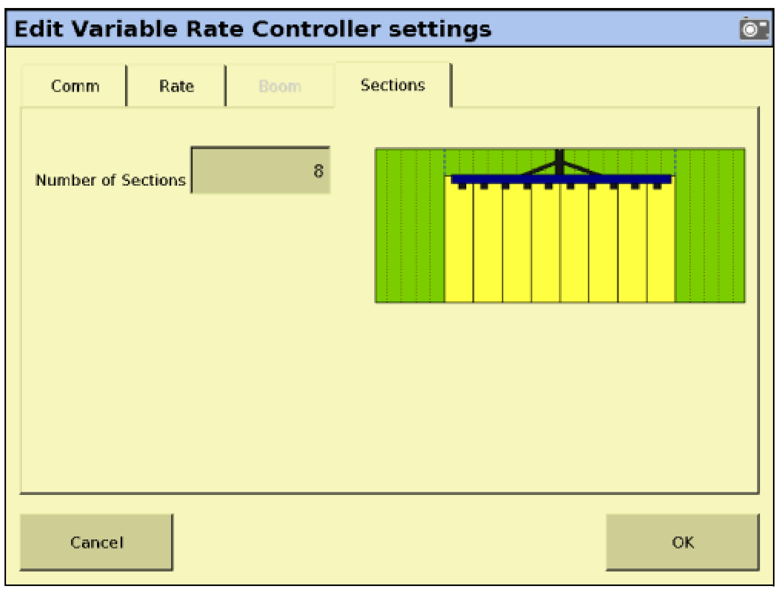
***Note** – The fields that appear on the screen depend on which controller you selected.*

2. Select the controller make from the *Controller* drop-down list.
3. Select the display port the controller is connected to from the *Port* drop-down list.
4. If the *Active Channel* field appears, enter the active channel name.
5. In the *Send Rate As* list, select the unit of measure.
6. In the *Rates* tab, enter the default rate and step size for the controller in the *Default Rate* and *Step Size* text fields

7. In the *Rate Snapping* list, select Enabled or Disabled:



8. Tap **OK**:



9. In the *Rates* tab, enter the number of sections in the *Number of Sections* field.

Configuring the variable rate controller

If you specified a variable rate controller type, the FM-1000 integrated display initiates communications with the controller each time that you open a field. Communications are terminated when you close the field.

If the FM-1000 integrated display cannot communicate with the controller:

- A message appears identifying the problem. If the specified controller type has a configurable baud rate, the error message includes details of the baud rate that the FM-1000 integrated display requires the controller to use.
- The *Applied rate* disappears from the Run screen.
- Variable rate logging is suspended while the controller is disconnected.

Raven

To use a Raven controller with an FM-1000 integrated display, the controller must:

- be GPS-ready
- use Raven's latest communications protocol, which was introduced in 1996.

If your controller is not GPS-ready or does not use the latest protocol, contact Raven for an upgrade pack.

To use a Raven controller, you need a special adaptor cable (Trimble P/N 69729) to connect to the FM-1000 cable (P/N 67091), which is connected to port D on the display.

Configuring the controller

For a Raven controller to operate correctly with an FM-1000 integrated display, the following *Data Menu* settings are required:

- BAUD: 9600
- GPS: Inac
- DLOG: ON
- TRIG: 1
- UNIT: Sec

Some Raven controllers may "forget" settings if power is disconnected. You must then reconfigure the controller.

Application width

When the FM-1000 integrated display is connected to a Raven controller, the total boom section width must be set to match the *Application Width* setting in the *Implement Boom Setup* screen.

CAUTION – The first boom section width set on the Raven controller ***must*** be greater than 0. If you set it to 0, the display will not communicate with the controller.

The FM-1000 integrated display varies the width of the coverage polygons according to the number of boom sections, but it does not know the ***absolute*** width of each boom section—it only knows the ***relative*** width of each boom section with respect to the total boom section width.

When recording coverage polygons, each section is considered to be a percentage of the *Application Width* set in the FM-1000 integrated display *Implement Boom Setup* screen. For example, if you create an intentional overlap to avoid gaps in the application coverage by making the application width greater than the swath width. This proportionally changes the recorded width of each boom section.

Using the controller

To allow the rates being sent by the FM-1000 integrated display to be used by the Raven controller, the channel must be set to Rate 1 (SCS4XX, SCS6XX) or to Product X Auto (SCS7XX).

If the controller is set to Rate 2 or Manual, the controller ignores the rates being sent, but the display still records the applied rates.

Limitations

Set the baud rate to 9600. Some older controllers are only capable of 1200 baud—these controllers need to be upgraded.

CAUTION – Some Raven controllers do not support zero rates. If the target rate is zero, and spray is still being applied, you must turn off the boom sections manually.

Rawson and New Leader

The Rawson and New Leader controllers use a nominal flow rate (Yield) and a step size to describe rates.

Set the *Default rate* in the *Edit Variable Rate Controller settings* screen to match the *Yield* value (or nominal flow rate) in the Rawson controller.

Any non-zero rate will be adjusted to the nearest value that the controller can select. A rate of zero turns off the hydraulic drive.

Note – *For best result when creating prescriptions, use rates in 2%, 4%, or 6 $^{2}/_{3}$% increments of the default rate. Select the percentage used on FM-1000 integrated display.*

If you have a dual-channel Rawson Accu-Rate controller, see page 551.

Configuring the controller

To allow the display to change the rates on the controller, the controller must first be put into GPS mode. Otherwise, the display will log only the rates being used:

1. Turn on the controller.
2. Tap the **MODE** button twice.

3. Tap the **SET** button to switch the controller between GPS and non-GPS.

Communications

Connect the FM-1000 integrated display to the controller with Rawson cable (P/N 69730) and Trimble cable (P/N 67091) and set the controller baud rate to 9600.

Using the controller

When in GPS mode, the hydraulic drive operates only when both the switch and the display allow the drive to be on. Set the hydraulic drive switch on the controller to the ON position. If you need to quickly turn off the hydraulic drive, use the switch on the controller.

Non GPS mode

The FM-1000 integrated display sends commands to the controller. If communication cannot be established, it may be because the controller is set to Non GPS mode. A message appears and gives you the option to continue in Non GPS mode.

If the controller is set to Non GPS mode, the display still shows and records as-applied rates. If a prescription is loaded, target rates appear for reference, but these are not used by the controller. In this mode, you must vary rates manually on the controller.

Loss of communication

In GPS mode, if communication with a Rawson controller is lost, the display does not report an error until you cross into a region of the prescription that specifies a different rate.

In Non GPS mode, the display has no way of knowing when communication with a Rawson controller is lost.

Special note on using a Rawson Accu-Rate controller

The display can send rates and record coverage for the Rawson Accu-Rate controller for only one drive at a time: either Drive A or Drive B.

To correctly send rates to the controller and log coverage based on the drive master switch, do the following:

- To operate both drives, set the drive that is ***not*** being controlled by the display to *Non GPS mode* (see above).
- Connect the FM-1000 integrated display Variable Rate cable to the COM port that matches the drive:
  - To control Drive A, connect to COM A.
  - To control Drive B, connect to COM B.
- When you use Drive B, set the COM port to COM B. Drive A does not have a configuration for this and will always use COM A.

- Set Bit 7 mode to off. Bit 7 mode sends two prescriptions and is not supported by the FM-1000 integrated display.

Hardi 5500

***Note** – Information regarding the Hardi 5500 configuration will be published in later versions of this user guide.*

Flex-Air

The FM-1000 integrated display can send rates to the Tyler Flex-Air variable rate controller. The controller can have four channels: main, liquid, co-applicator, and supplemental. Rates from all channels are recorded in the variable rate logging .dbf file, but the FM-1000 integrated display can send rates to only one channel at a time — the active channel.

The Tyler Flex-Air controller uses GPS speed sent by the FM-1000 integrated display.

Using the Tyler Flex-Air controller

The *Total_Qty* field in the variable rate logging .dbf file, and the *Avg_Rate* field in the EventHistory .dbf file, record statistics for the active channel. If you want to use these statistics, start a new event ***before*** you change the active channel.

Application width

You can individually configure the widths of the boom sections on the controller. The FM-1000 integrated display draws coverage logging at the width of the sum of all the boom sections. If you turn boom sections off, the FM-1000 integrated display varies the width of the coverage polygons according to which boom sections are on.

Setting any other features of the variable rate controller

Coverage mapping

The FM-1000 integrated display receives the applied rate and can also receive the number of active boom sections from a variable rate controller. It does not receive any information about the swath or application width.

To accurately record coverage maps, if your controller does not send the number of active boom sections, make sure that you set the application width to match the agricultural equipment that you are using (for example, the width of the spray boom).

Target and applied rates

The FM-1000 integrated display can control only a single channel at any one time. This active channel is specified in the *Edit Variable Rate Controller settings* screen. The target and applied rates shown on the Run screen are specific to this active channel.

Units

Most controllers can be configured to use either US Imperial or metric units of measurement. Each channel can be configured to use different types of units (for example, lb/ac, oz/ac, or gal/ac.).

When constructing prescription maps, make sure that the maps use the same units that the controller is configured for.

Alarms

If you want low limit and target rate alarms, set these on the variable rate controller. You can also set a default rate to be used if you go off the prescription or do not have a prescription. For more information, refer to the documentation provided with your variable rate controller.

Additional information for non-Trimble variable rate controllers

Prescriptions

You can define variable rate controller setup data, and load prescription files that define the rates to be applied in different areas of the field. This information is used to send target rates to the variable rate controller. Applied rates are received from the controller, and both target and applied rates are shown on the screen. In addition, data relating to the variable rate application may be logged to the card.

The information describing prescriptions for the EZ-Boom system also applies to non-Trimble variable rate controllers. See Additional information about the EZ-Boom system, page 542.

CHAPTER

17

The Remote Output Plugin

In this chapter:

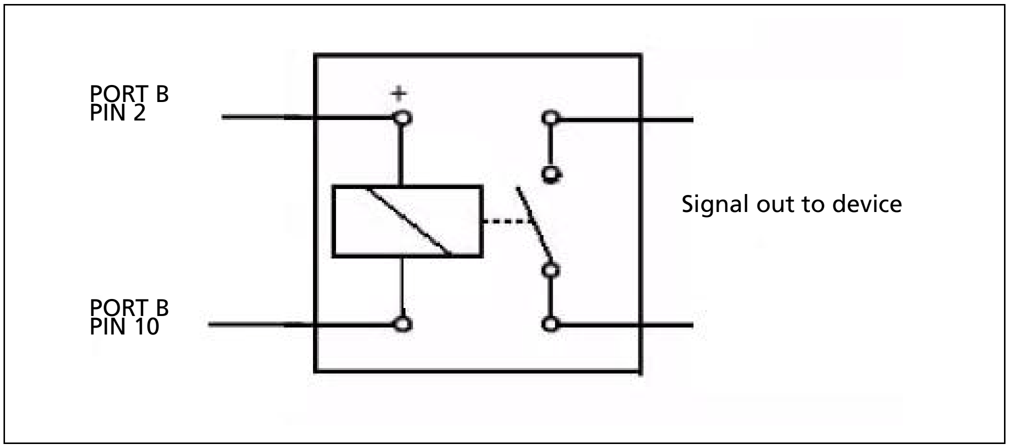
- Connecting remote output
- Configuring the Remote Output plugin
- Calibrating the lead time for your implement

When remote output is activated, the FM-1000 integrated display outputs pulses for an external device. For example, you can use a remote output signal to control a tree planter.

This chapter explains how to configure the Remote Output plugin so that the display can output data.

Connecting remote output

The signal that is output on pin 2 of the FM-1000 integrated display's B port is a 5 volt signal with a rating of approximately 70 mA; this signal controls the device that requires the remote output. The relay is grounded to pin 10 of the display's B port.



Configuring the Remote Output plugin

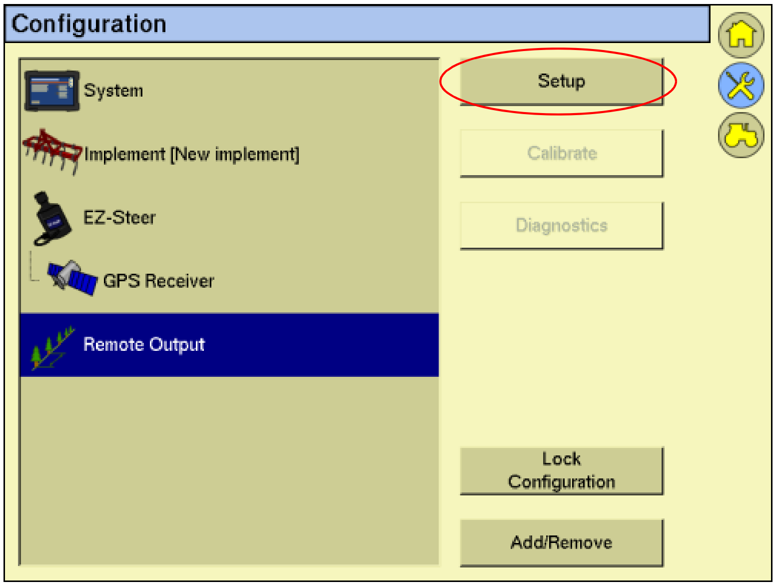
When remote output is activated, the FM-1000 integrated display sends pulses to an external device. For example, you can use a remote output signal to control a tree planter.

Note – *Pulse output occurs only when coverage logging is enabled.*

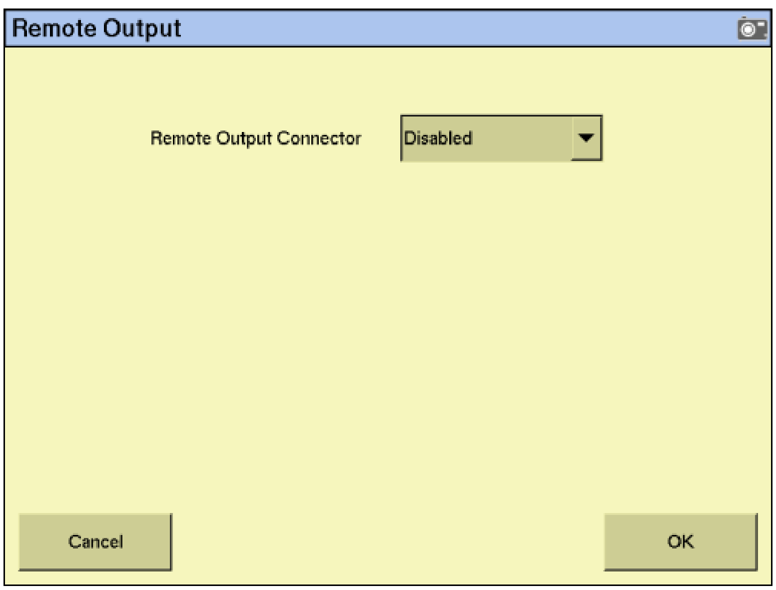
To enable pulse remote output:

1. Install the Remote Output plugin. See Adding or removing a plugin, page 194.

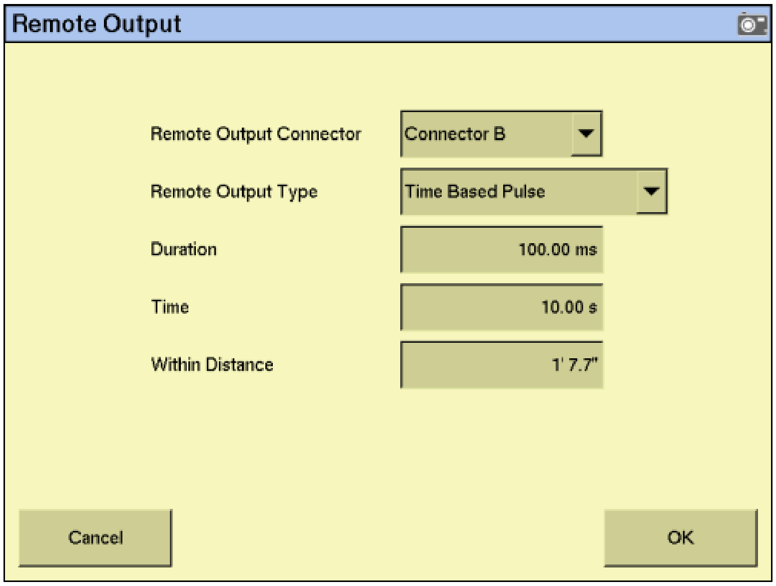
2. From the *Configuration* screen, select the Remote Output plugin and then tap **Setup**:



The *Remote Output* screen appears:



3. From the *Remote Output Connector* drop-down list select *Connector B*. The default option is *Disabled*. More options appear:



4. From the *Remote Output Type* drop-down list, select one of the following:

If you select…	Then enter…
Time Based Pulse	• the pulse interval in seconds in the *Time* field. • the pulse duration in milliseconds in the *Duration* field.
Distance Based Pulse	• the *Lead Time*. See Calibrating the lead time for your implement, page 559. • the Distance in meters/decimal feet/feet and inches in the *Distance* field. The pulse occurs at each increment of this distance. ***Note –** The first pulse occurs at the A point. Pulse remote output is not recommended for Headland patterns.* • the duration of the pulse in milliseconds (ms) in the *Duration* field. • the distance in the *Within Distance* field. The pulse occurs only when the vehicle is within this distance of being online. If the vehicle is more than this distance offline, no pulse occurs.
When Within Area Feature	the *Lead Time*. See Calibrating the lead time for your implement, page 559. ***Note –** The pulse occurs only when Remote Output is enabled. You must also enable Remote Output for each area feature individually in the Mapping plugin setup. See Creating an area feature, page 104.*
When Engaged	nothing: There are no options to set. Remote output occurs when the system is engaged.

5. Tap **OK**.

Remote output is now configured. If you are using Distance Based Pulse or When Within Area Feature, calibrate the *Lead Time* setting to match your implement.

Calibrating the lead time for your implement

There is usually a gap between the time when the system generates a pulse and the time when that pulse triggers an action on the implement. To compensate for this system delay, you can set a ***lead time*** to trigger the pulse slightly early, so that the action occurs at the correct location.

For this calibration, you drive the vehicle along a line and back, using the Remote Output plugin to mark points on the ground. If the remote output is correctly calibrated, the points that you generate when driving in both directions will be close together.

This section describes some implement calibration steps. See also, Chapter 7, Implement Configuration.

Do the following:

1. Set the front/back offset. See page 559.
2. Calibrate the front/back offset. See page 559.
3. Set the lead time. See page 560.

Setting the front/back offset

CAUTION – You must configure the correct front/back offset. If you are using an Autopilot system, set the front/back offset to the distance from the ***fixed axle of the vehicle*** to the implement. If you are using manual guidance, set the front/back offset to the distance from the ***antenna center-point*** to the implement.

1. Accurately measure whichever of the following options is appropriate:
   - Autopilot systems: The distance between the fixed axle of the vehicle and the part of the implement where the trigger marks will be applied on the ground.
   - Manual guidance systems: The distance between the antenna center-point and the part of the implement where the trigger marks will be applied on the ground.
2. From the *Configuration* screen, tap **Implement Setup** and then enter this value as the *F/B Offset* distance on the *Implement Boom Setup* screen.

Calibrating the front/back offset

1. Create a straight AB Line.
2. In the Remote Output plugin, set the *Lead Time* to 0.
3. Drive ***as slowly as possible*** down the AB Line from point A to point B, marking points on the ground where the remote output triggers.
4. At the end of the line, turn the vehicle around.

5. Drive back down the line from point B to point A, marking another set of trigger points.
6. Measure the distance between the points from the first run and the points from the second run.
7. Divide the distance by two.
8. Adjust your *Front/Back Offset* value by this amount:
   - If the return points are nearer where you originally started than the first set of points, increase the F/B offset.
   - If the return points are further from where you originally started than the first set of points, lower the F/B offset.

Setting the lead time

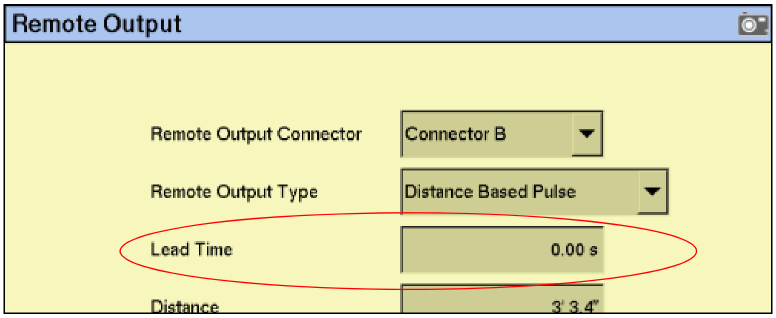
1. Drive ***at your intended application speed*** down the AB Line from point A to point B, marking points on the ground where the remote output triggers. Ensure that your speed remains constant.
2. At the end of the line, turn the vehicle around.
3. Drive back down the line from point B to point A, marking the trigger points.
4. Measure any offset distance between the points from the first run and the points from the second run.
5. Divide the distance by two.
6. Convert your speed from mph to inches/second:

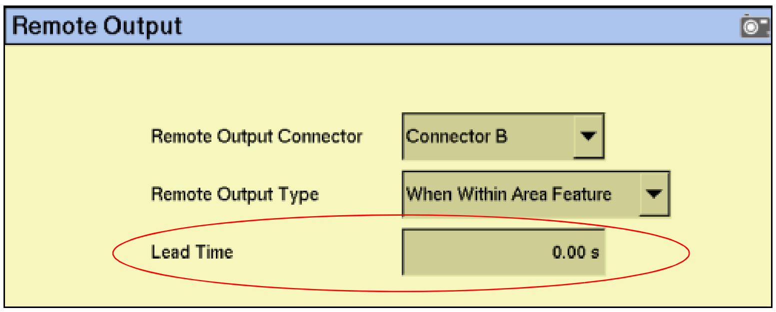
$$\text{inches/second} = \text{mph} \times 17.6$$

7. To calculate the *Lead Time* setting, divide the distance between the points (in inches) from Step 5 by the vehicle speed (in inches/second):

$$\frac{\text{Half the distance between points (inches)}}{\text{Speed (inches / second)}} = \text{Lead Time (seconds)}$$

8. Enter the lead time on the *Remote Output* screen:





For example, if a 4 mph pass creates a 14" distance between each set of points:

a. Divide the distance between the points by 2.

   In this example, 14" / 2 = 7".

b. Convert the speed from mph to inches/second.

   4 mph = (4 x 17.6) = 70.4 inches/second.

c. Divide the halved distance between the points by the speed:

$$\frac{\text{7 inches}}{\text{70.4 inches/second}} = \text{0.099 (Lead Time in seconds)}$$

d. Drive along the AB line and then back at your application speed while you create trigger points.

e. Ensure that the trigger points are sufficiently close to one another.

If the gap between the points is unacceptable, repeat the calibrations.

CHAPTER

18

The Serial Data Input Plugin

In this chapter:

- Connecting serial data input
- Configuring serial data input

When serial data input is activated, the FM-1000 integrated display can receive and log NMEA messages from an external device (for example, an infra-red sensor).

This chapter explains how to configure the display to receive data.

Connecting serial data input

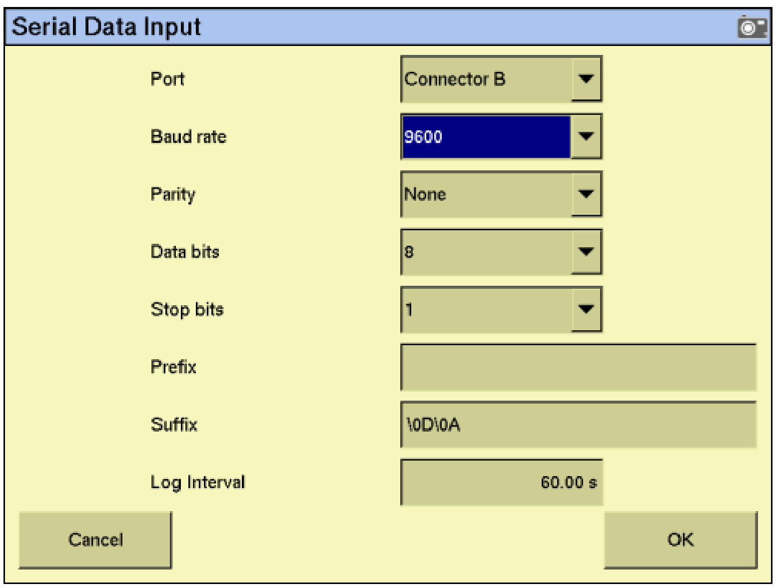
To connect a device to the FM-1000 integrated display, connect the Variable Rate Control cable (P/N 67091) to the port D connector on the display.

The other end of the Variable Rate Control cable connects to a serial connector.

***Note** – An additional adaptor may be required depending on the pin-out for the serial device.*

Configuring serial data input

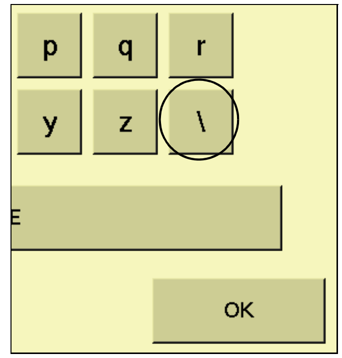
1. Install the Serial Data Input plugin. See Adding or removing a plugin, page 194.
2. On the *Configuration* screen, select the Serial Data Input plugin and then tap **Setup**:



3. In the *Port* list, select the port that the device is connected to. It is usually P5 Serial I/O. Configuration settings for that port appear on the right of the screen.
4. Set the following to the values at which the sensor outputs data:
   - Baud rate
   - Parity
   - Data bits
   - Stop bits
5. The *Prefix* and *Suffix* fields are the start and end points of the data you want to collect.
   - To log data from the start of the line, leave the *Prefix* field empty.

- To drop introductory characters, enter them in the *Prefix* field. For example, if you receive data that begins "$GPGGA...", enter "\24GP" in the *Prefix* field. The logged data will begin "GGA..."

Note – *"\24" is the ASCII code for "$".*



- To log to the end of the line, keep the default *Suffix* field ("\0D\0A").

6. Enter the log interval. This determines how regularly the data is written to the file.

The system is now configured to receive remote data from an external device.

CHAPTER

19

The Productivity Monitoring Plugin

In this chapter:

The Productivity Monitoring plugin enables the FM-1000 integrated display to interface with an Enalta CDA 1000 display, for sugar cane harvesting.

This chapter explains how to combine the two systems so that the information from both displays appears on the FM-1000 integrated display.

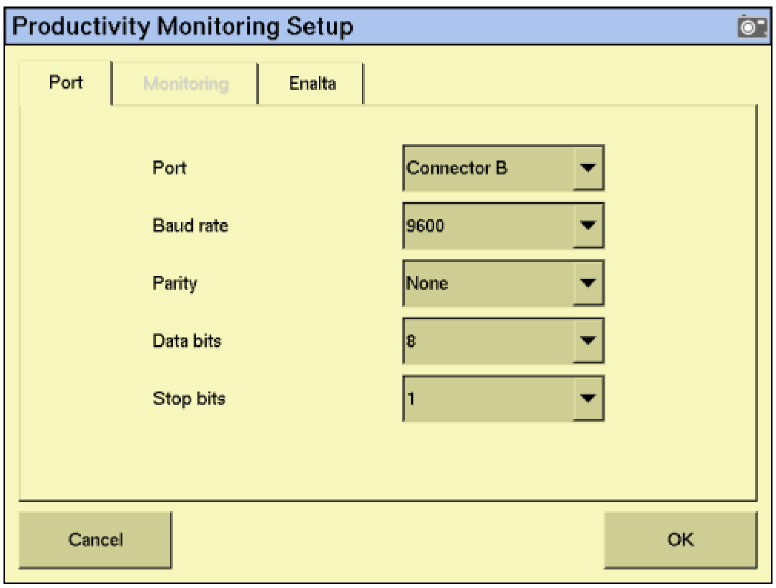
Note *– To use this plugin, you must have an Enalta CCT system.*

Installation

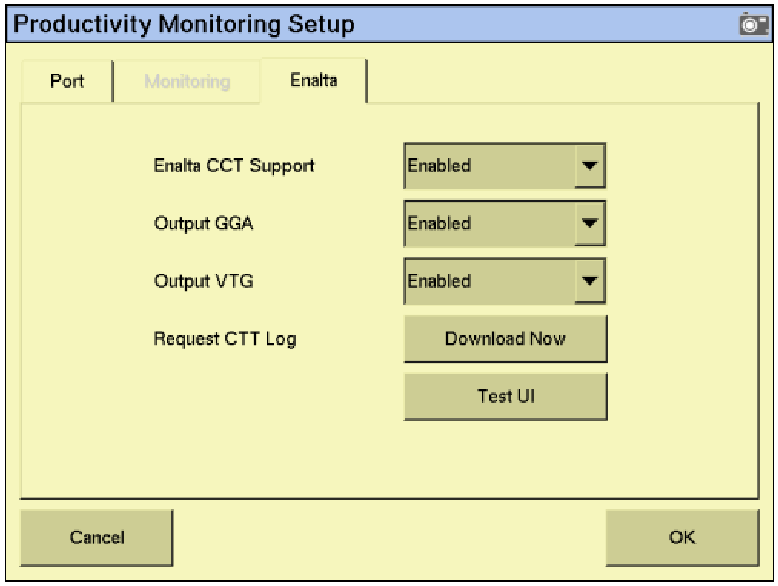
1. Install the FM-1000 integrated display, harness, and GPS receiver. See Installing the display, page 39.
2. Connect the Enalta sensors to a serial port on the FM-1000 integrated display harness.

Configuring the Productivity Monitoring plugin

1. Install the Productivity Monitoring plugin. See Adding or removing a plugin, page 194.
2. On the *Configuration* screen, select the Productivity Monitoring plugin and then tap **Setup**:



3. In the *Port* list, select the port on the FM-1000 integrated display harness that the Enalta sensors are connected to.
4. Adjust the port settings.



5. In the *Enalta* list select **Enable Enalta CCT** to enable the Enalta system.
6. Select the NMEA messages that the systems will use to communicate. You can select:
   - GGA: Select **Enable GGA**.
   - VTG: Select **Enable VTG**.
   - GGA and VTG messages: Select both buttons.
   - RMC
7. Enter the following settings:

Item	Description
Logging Rate While Field Open	The rate at which data is logged when a field is open. (1 sec–300 sec).
Logging Rate While Field Closed	The rate at which data is logged when the field is closed (1 sec–300 sec).
Minimum Operating Speed	When a field is open and the vehicle speed drops below this speed, a pop-up message appears onscreen asking the driver to select a reason for the low speed. The system will not operate until the driver selects a reason.
Maximum Stoppage Time	When a field is open and the vehicle stops moving for longer than this time, the system prompts the driver for reason for the stoppage. The system will not operate until the driver responds.
Productive When	The system is marked “productive” when a condition is active: • None: The system is not productive. • Logging: On = productive; Off = non-productive • AP Engaged: Engaged = productive; Disengaged = non-productive • Minimum Speed: Above = productive; Below = non-productive

Operation

When you open a field, enter the additional details.

When the conditions that you set in the configuration are met, they trigger pop-up messages on the FM-1000 integrated display.

CHAPTER

20

The Yield Monitoring Plugin

In this chapter:

The FM-1000 integrated display can access yield monitoring information from John Deere combines and Ag Leader displays.

This chapter describes how to configure the FM-1000 integrated display for use with various yield monitoring platforms.

Supported Platforms

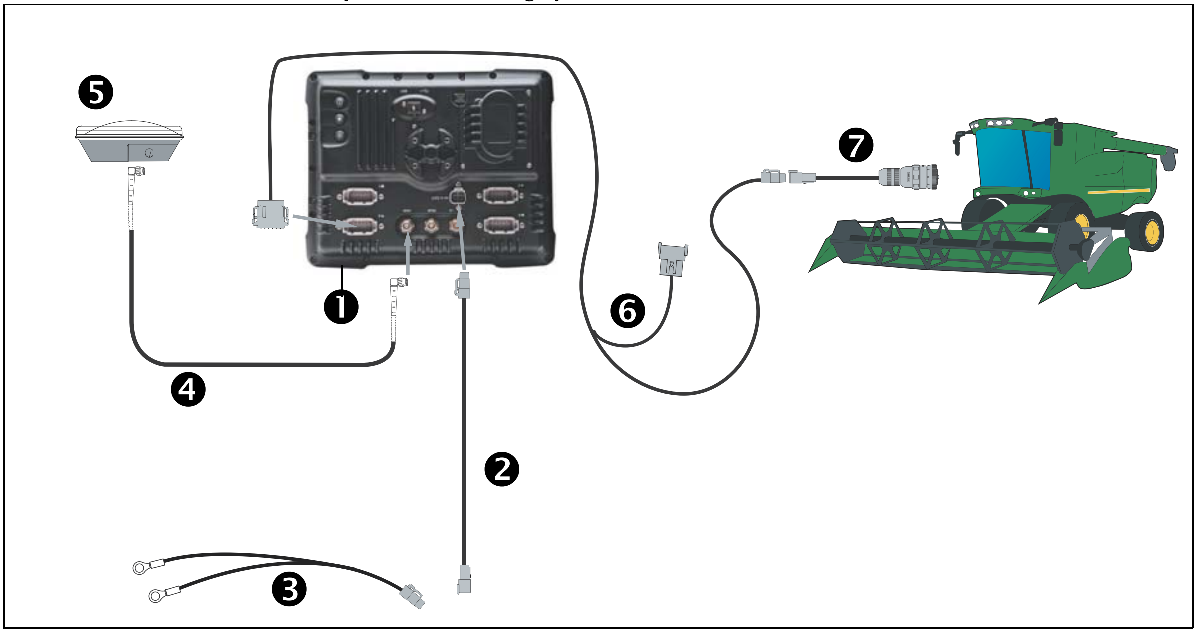
The FM-1000 integrated display supports yield monitoring information from the following combines:

Make	Model	See page...
John Deere	JD 60 series	573
	JD 70 series	573
Ag Leader	YM 2000	574

Installation

FM-1000 / John Deere 9x60 or 9x70 yield monitor

This figure shows how to connect the FM-1000 integrated display to the John Deere 9x60 or 9x70 yield monitoring system:



Item	Description	Trimble part number
1	FM-1000 integrated display	93100-01
2	FM-1000 power cable	66694
3	FM-1000 basic power cable	67258
4	8 m GPS TNC/TNC RT angle cable	50449
5	AG25 GNSS antenna	68040-00S

Item	Description	Trimble part number
❻	FM-1000 to CAN cable with port replicator	75407
❼	Display to John Deere 9x70 (all) or 9x60 non-ATR ready Display to John Deere 9x60 ATR ready	76509 77692

Connecting the John Deere 60 series combine

***Note –** The John Deere 60 series combine must have moisture sensor version 1.20c, installed for yield monitoring to function correctly. For more information, see Updating the Moisture Sensor (60 Series combines only), page 589.*

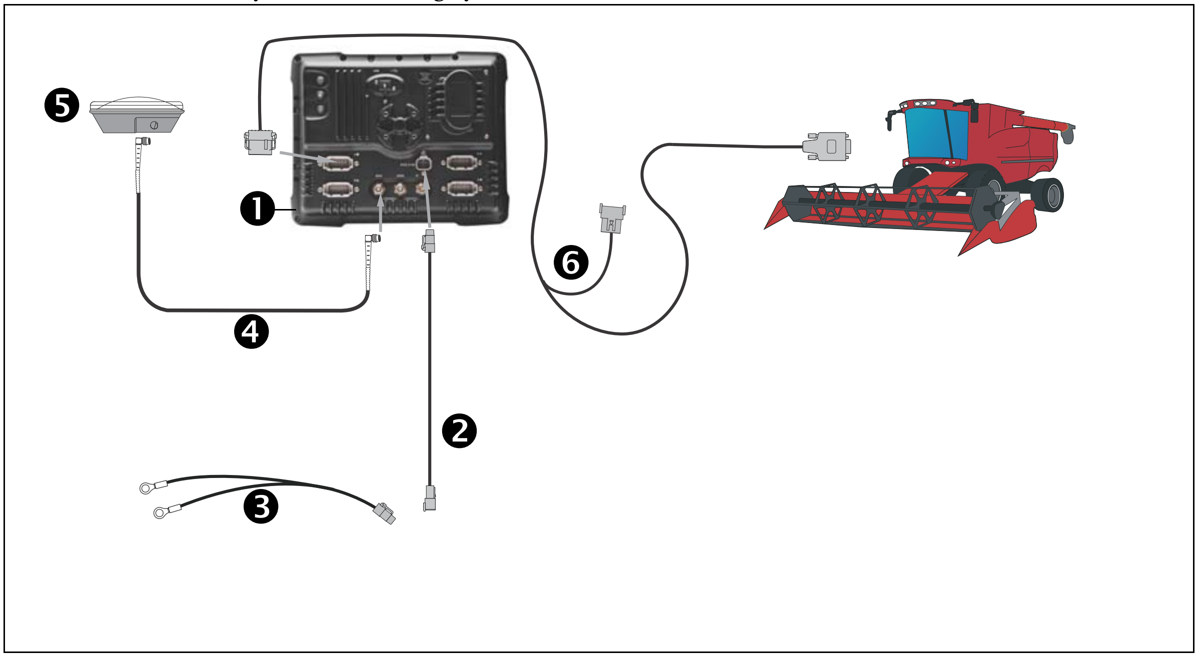
1. Ensure that the antenna is correctly installed and run the cable down the right-hand side of the cab. Run the antenna cable through the hole to come into the back right corner of the cab. Plug the antenna cable into the FM-1000 integrated display.
2. Plug the yield monitoring cable into the diagnostics connector on the combine. For ATR-ready vehicles, use cable P/N 77692. For NONATR-ready vehicles, use cable P/N 76509.
3. Connect the yield monitoring cable to the FM-1000 cable (P/N 75407) which is connected to Port B on the display. Trimble recommends that you do not use Port A.

Connecting the John Deere 70 series combine

1. Ensure that the antenna is correctly installed and run the cable down the right-hand side of the cab. Run the antenna cable through the hole to come into the back right corner of the cab. Plug the antenna cable into the FM-1000 integrated display.
2. Plug the yield monitoring cable (P/N 76509) into the diagnostics connector on the combine.
3. Connect the yield monitoring cable to the FM-1000 cable (P/N 75407) which is connected to Port B on the display. Trimble recommends that you do not use Port A.

FM-1000 / AgLeader YM2000 yield monitor

This figure shows how to connect the FM-1000 integrated display to the AgLeader YM 2000 yield monitoring system:



Item	Description	Trimble part number
❶	FM-1000 integrated display	93100-01
❷	FM-1000 power cable	66694
❸	FM-1000 basic power cable	67258
❹	8 m GPS TNC/TNC RT angle cable	50449
❺	AG25 GNSS antenna	68040-00S
❻	Display to DE9 RS232 cable	67091

Connecting the Ag Leader YM 2000

1. Ensure that the antenna is correctly installed and run the antenna cable into the cab for best desired fit.
2. Plug yield monitor cable (P/N 67094) into port A or port B and run the cable to the YM 2000.
3. Plug the yield monitoring cable (P/N 67091) into the serial connector on the YM 2000.
4. Connect the yield monitoring cable to the FM-1000 cable (P/N 75407) which must be connected to port A, or port B on the rear of the FM-1000 integrated display.

Configuration

Configuring the FM-1000 integrated display to perform yield monitoring

Units of measure

Select the unit of measure to be used in the Language and Units screen in the FM-1000 integrated display setup. For more information, see the Selecting the language, units of measure, and keyboard layout, page 100.

Display units	Select for...
Metric	tonnes per hectare
Feet and inches	bushels per acre
Decimal feet	tons per acre

Note – *For hundred weight, select Feet and Inches and then set the bushel weight to 100lbs.*

General tab

Field name	Description
Yield monitor type	Select the type of monitor that will be gathering and sending the yield data.
Combine series	Indentify sensor type and communication protocol.
Port Connection	Connection of sensors to FM-1000 integrated display.
Stop Head Height	Sensor that reads the header height value that defines the logging start and stop.
Grain Flow Delay	Compensates where crop is processed in comparison to where it was harvested.

Crop

Field Name	Description
Crop Type	Identifies the crop being harvested and sets the default moisture and test weight.
Standard Moisture	Calculates dry weight.
Crop Weight	Calculates weight to bushels (lbs or kg).

Crop weights

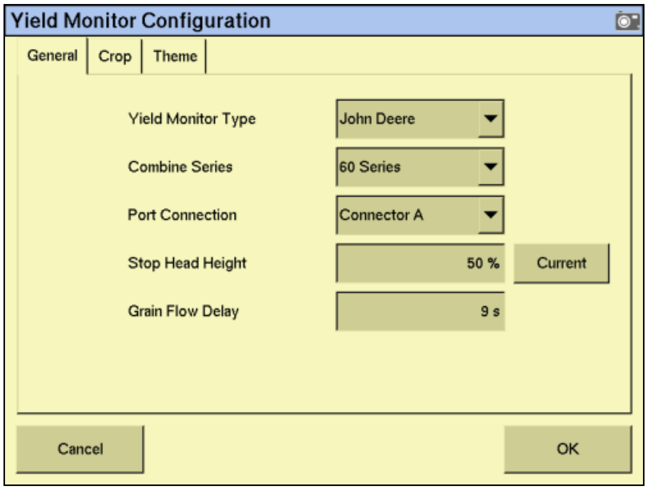
Crop	Bushel weight (lbs)	Dry moisture (%)
Alfalfa	60.0	14.0
Barley	48.0	14.0
Canola	60.0	10.0
Chick peas	60.0	12.0

Crop	Bushel weight (lbs)	Dry moisture (%)
Corn	56.0	15.5
Edible beans	60.0	14.5
Flax	60.0	14.0
Grass seeds	14.0	14.0
Lentils	60.0	13.0
Lupines	60.0	12.0
Millet	50.0	14.0
Mustard	18.0	13.0
Navy beans	60.0	15.5
Oats	32.0	14.0
Peas	60.0	14.5
Popcorn	56.0	15.5
Rice	45.0	14.0
Rye	56.0	13.0
Safflower	45.0	13.0
Sorghum	56.0	13.0
Soybeans	100.0	13.0
Sun flower	25.0	14.0
Wheat durum	60.0	13.5
Wheat spring	60.0	13.5
Wheat winter	60.0	13.5
Optional grain	Bushel weight is based on crop choice	Moisture is based on crop choice

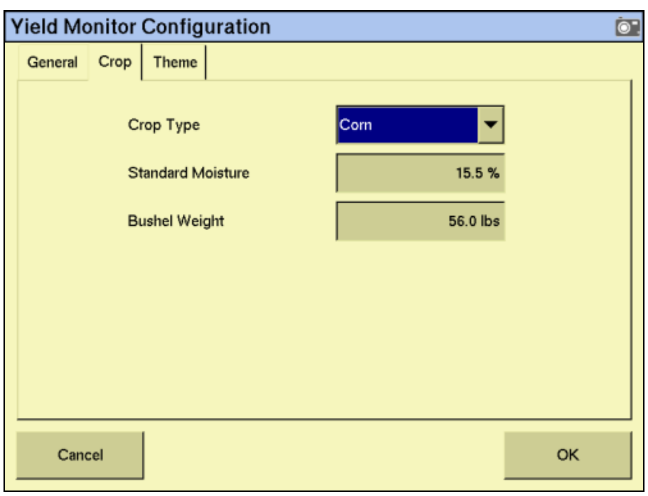
Configuring the John Deere Yield Monitor

1. Install the Yield Monitoring plugin. For more information, see Adding or removing a plugin, page 194.
2. From the *Configuration* screen, select the Yield Monitoring plugin and then tap **Setup**. The *Yield Monitoring Settings* screen appears.

3. Select the *General* tab:



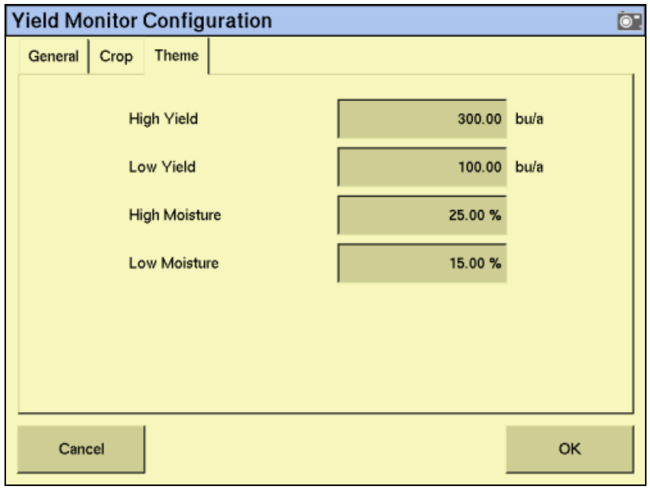
4. In the *Yield Monitor Type* drop-down list, select the appropriate John Deere combine.
5. In the *Combine Series* drop-down list, select your combine series.
6. In the *Port Connection* drop-down list, choose Connector B.
7. Select the *Stop Head Height* field and then enter a height (this value must be at least 1 number lower then the John Deere Stop Head Height.).
8. In the *Grain Flow Delay* field, enter the time in seconds that it takes the grain to travel from the header to the clean grain tank.
9. Select the *Crop* tab:



10. In the *Crop Type* drop-down list, select the crop type.
11. In the *Standard Moisture* field, enter the market value.
12. In the *Crop Weight* field, enter the market value.

Note – *The Standard Moisture and Crop Weight values are not the calibration values.*

13. Select the *Theme* tab:

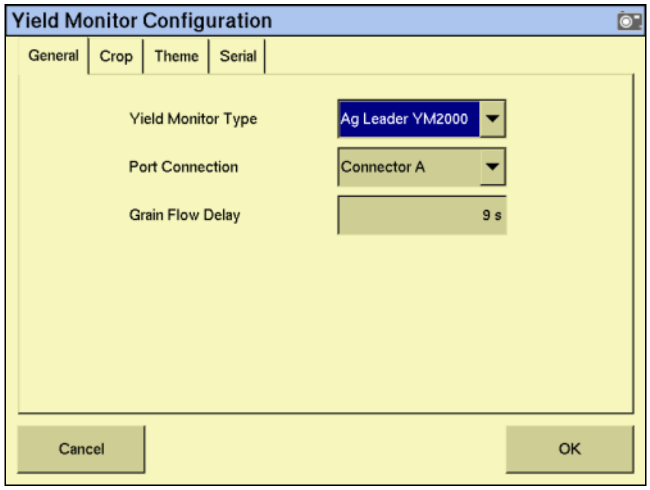


14. In the *High Yield* field, enter a value.
15. In the *Low Yield* field, enter a value.
16. In the *High Moisture* field, enter a value.
17. In the *Low Moisture* field, enter a value.
18. Tap **OK**.

Configuring the YM 2000 Yield Monitor

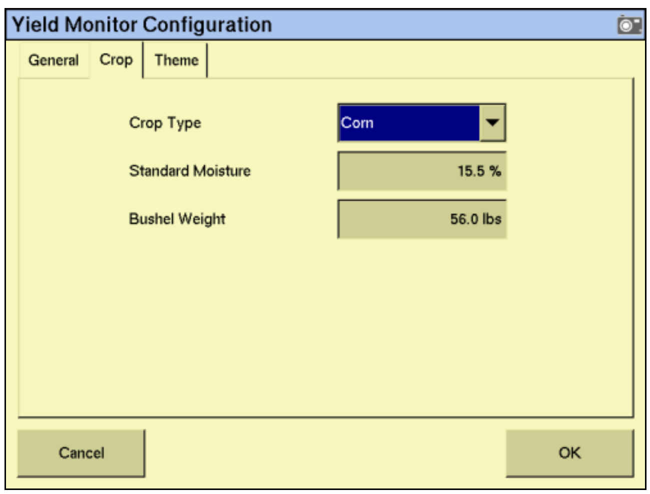
1. Install the Yield Monitoring plugin. For more information, see Adding or removing a plugin, page 194.
2. From the *Configuration* screen, select the Yield Monitoring plugin and then tap **Setup**. The *Yield Monitoring Settings* screen appears.
3. Select the *General* tab.
4. In the *Yield Monitor* drop-down list, select Ag Leader YM 2000.

5. In the *Port Connection* drop-down list, choose Connector A or Connector B:



6. In the *Grain Flow Delay* field, enter the time in seconds that it takes the grain to travel from the header to the clean grain tank.

7. Select the *Crop* tab:

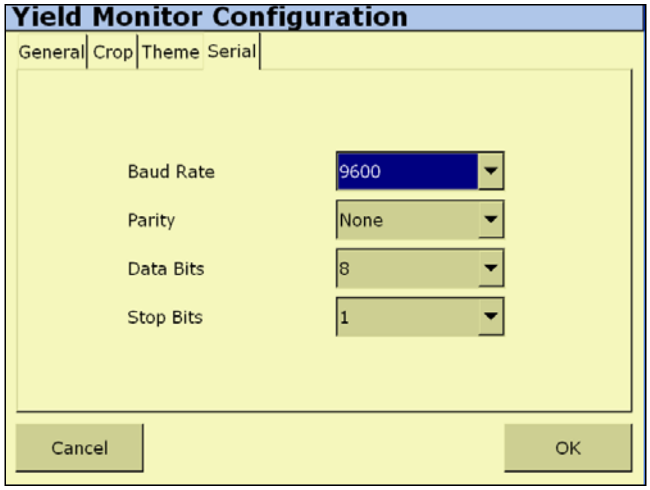


8. In the *Crop Type* drop-down list, select the crop type.

9. In the *Standard Moisture* field, enter a value.

10. In the *Crop Weight* field, enter a value.

11. Select the *Serial* tab:



12. In the *Baud Rate* field, enter a value.
13. In the *Parity* field, enter a value.
14. In the *Data Bits* field, enter a value.
15. In the *Stop Bits* field, enter a value.
16. Tap **OK**.

YM2000 Step Action

The following steps explain how to configure the YM2000 display to communicate with the FM-1000 display.

1. Press the SETUP key until LOGGING DEVICE=NONE or EXT or ?M CARD appears on the display.
2. Use the top UP or DOWN ARROW keys to set this to **LOGGING DEVICE=EXT**.

Calibration

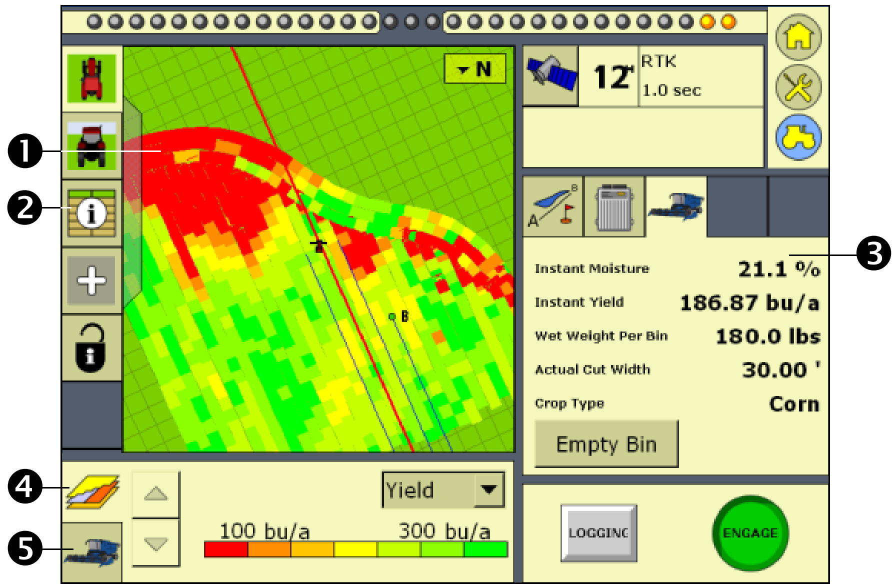
Calibrating yield monitoring

To calibrate moisture sensor and yield monitor on John Deere combine:

- 60 series combines use Greenstar Monitor
  - See Original Greenstar Display (60 Series Combines), page 587.
- 70 series combines use the Command Center
  - See Command Center (70 Series Combines), page 588.

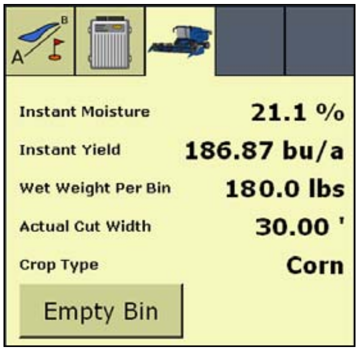
Operating the Yield Monitor plugin

Run Screen



	Run screen item
❶	Coverage map
❷	Information screen button
❸	Plugin tab
❹	Coverage tab
❺	Yield monitor status tab

Plugin tab



	Plugin tab item
❶	Instant moisture
❷	Instant yield
❸	Wet weight per bin
❹	Actual cut width (auto and manual)
❺	Crop type
❻	Empty bin (clears the wet bin weight)

Coverage map layers

User-defined minimum and maximum levels with seven ranges:

- Yield
- Moisture

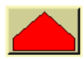
Yield Monitor status buttons

Auto width detection aids accurate area calculations by automatically reducing the cut width when entering or exiting point rows and other previously harvested areas.

If you are harvesting a row crop with pre-configured rows then the width reduces on an overlap by one row at a time.

The yield monitor buttons at the bottom of the map screen allow you to manually reduce the cut width; each button reduces the cut width by one sixth of the head width.

This is useful for areas with no crops, or areas where another combine may have harvested.

	1	Buttons pressed: harvesting and logging works as usual. A green icon appears on the button when harvesting.
	2	Press on the sections/row. A red button appears. The map shows a reduced swath area by an amount (1/6th per button).
	3	The button turns gray when the active rows overlap previously harvested areas.
		There is no change when logging is disabled.

Information screen

The following are status items that can be added on the Information screen.

	Yield *Status* screen item	Description
❶	Average yield (per bin and per field)	Displays the average dry yield in bushels per acre.
❷	Bin moisture	Displays the average grain moisture of the bin.
❸	Dry weight (per bin and per field)	Displays the amount of crop harvested in metric tonnes, pounds, or imperial tons of grain.
❹	Field moisture	Displays the average grain moisture.
❺	Grain flow	Displays the dry bushels per hour you are harvesting.
❻	Header height	Displays a number to indicate the position of the head. This number is not in feet or inches, but is a number that is relative to the height of the header.
❼	Instant moisture	Displays the instantaneous grain moisture if you are harvesting. If you are not harvesting the average grain moisture is displayed. ***Note –*** *You can select this in a manual moisture mode.*

	Yield *Status* screen item	Description
❽	Instant yield	Displays the dry yield in bushels per acre. If you are harvesting, the instantaneous yield is displayed and will change every second. If you are not harvesting the average yield is displayed.
❾	Wet weight (per bin and per field)	Displays the estimated wet weight in metric tonnes, pounds, or imperial tons of grain.

Error messages

Error message	Cause	Resolution
State 1 - During boot up	**60 Series** • Moisture unit • Head unit • Armrest unit **70 Series** • Moisture sensor • CC1 unit • Cab unit • Corner post **YM 2000** • Cannot detect YM 2000 • Serial port	1. Ensure that the correct cable is installed. 2. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B); is there another value other than zero for CAN messages? 3. *(60 Series Combines)* Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 has been changed. 4. *(70 Series Combines)* Change the Crop Type in the command center and make sure it changes on the FM-1000 integrated display. 5. Raise the head up or down to see if the display will show a change for header height. 6. If Step 1 and Step 2 work, log field data.
State 2 - During boot up	Never sees the armrest, header unit, moisture sensor, or reports which one is not visible by the FM-1000 integrated display.	1. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B); is there another value other than zero for CAN messages?. 2. *(60 Series Combines)* Make sure Moisture Sensor has version 1.20C loaded. 3. *(60 Series Combines)* Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 has been changed. 4. *(70 Series Combines)* Change the crop type in the command center and make sure it changes on the FM-1000. 5. Raise head up or down to see if the display shows a change for header height.

Error message	Cause	Resolution
State 3 - During boot up	Will show which controller is not visible (armrest, header unit, moisture sensor).	1. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B); is there another value other than zero for CAN messages?. 2. *(60 Series Combines)* Make sure Moisture Sensor has version 1.20C loaded. 3. *(60 Series Combines)* Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 has been changed. 4. *(70 Series Combines)* Change the crop type in the command center and make sure it changes on the FM-1000. 5. Raise head up or down to see if the display shows a change for header height.
State 4	FM-1000 integrated display has lost communication from the CAN bus.	1. Check cabling. 2. Recycle Power (shut down the display and the combine and wait 20 seconds before powering the FM-1000 and the combine back up). 3. Make sure other logging devices are not connected to the CAN bus (disconnect Mobile Processor or GS2 display).

Other reasons why yield monitoring may not work.

Reason	Cause	Resolution
FM-1000 is not mapping.		1. Make sure the display Header Height setting is lower than John Deere's setting. 2. Ensure that the crop type is the same. ***Note –*** *The machine must be in normal harvesting operation mode.*
FM-1000 stops mapping periodically through the field.	The header could be raising and lowering past the Stop Logging Header Height setting.	Increase the Header Height setting on the FM-1000.
FM-1000 yield information does not match John Deere's information.	Different crop types may be selected.	Verify the crop types match in both displays.
Major jump, or extremely different weight values than shown on the John Deere monitor.	The Stop Head Height setting is lower than what the John Deere monitor shows. The John Deere monitor could be logging more data than the FM-1000 logs, therefore showing a larger value.	Set the Head Height to 100% on the John Deere display.

Third-party display instructions

Configuring the Stop Head Height on the Greenstar Monitor

1. Press 

2. Press 

for Harvest Monitor.

3. Position the header to 100%.

4. Press 

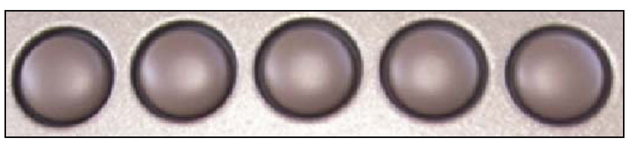
next to Record Stop Height.

Configuring the Stop Head Height on the Command Center

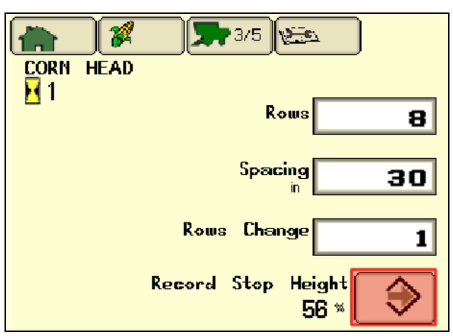
1. Navigate to Home screen on the Command Center.

2. Select the *Combine* icon  in the lower right corner of the screen.

3. Press the 3rd button from the left on the command center to select the *Combine* tab.



4. After *Combine* tab is selected, continue to press the 3rd button from the left until page 3 appears *(page numbers are located on the Combine Tab)*.



5. Position the header to 100%.

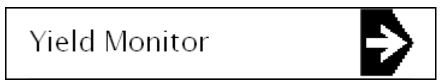
6. Press **Enter** on *Stop Head Height* screen to record the required stop header height.

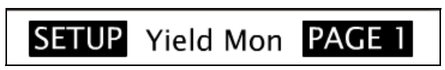
Calibrations

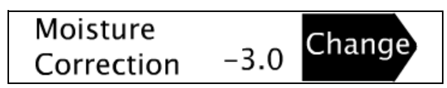
Original Greenstar Display (60 Series Combines)

Calibrate Moisture

1. Press 

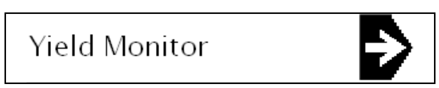
2. Select 

3. View page 1. 

4. Check moisture with a certified tester.
5. Calculate moisture correction *(certified tester reading minus the Greenstar reading)*.
6. Input the moisture difference. 

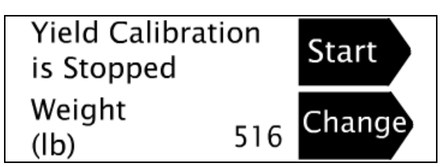
Calibrate Yield

1. Press 

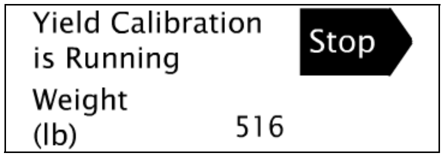
2. Select 

3. View page 2. 

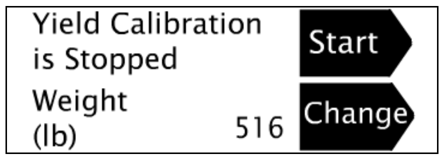
4. Verify that the combine's grain tank and the truck/wagon are both empty, and tap **Start**.



5. Harvest about 500 bushels, and hit **Stop**.



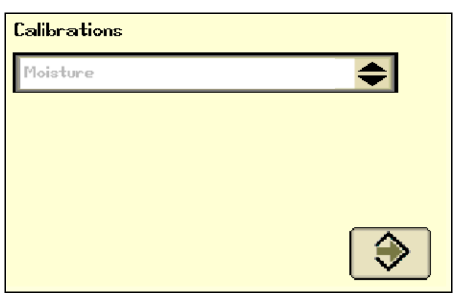
6. Unload the grain harvested during calibration onto truck/wagon.
7. Select button next change to enter the weight of the truck/wagon in wet pounds.



Command Center (70 Series Combines)

Calibrate Moisture

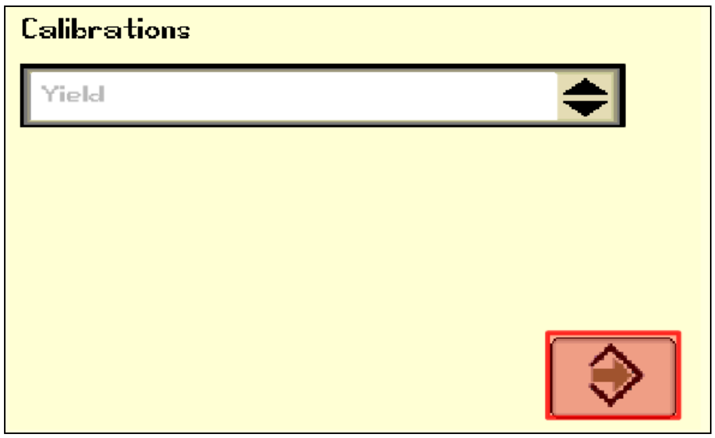
1. Navigate to Home screen on the Command Center.
2. Select 
3. Press  on the Command Center
4. Continue to press  until page 2 appears *(page numbers are shown on the Wrench tab)*.
5. In the *Calibrations* list, select Moisture.
6. Follow the steps to perform the calibration.



7. Highlight the arrow and then press the *Confirm* switch on the armrest.

Calibrate Yield

1. Navigate to Home screen on the Command Center.
2. Select  .
3. Press  on the Command Center.
4. Continue to press  until page 2 appears *(page numbers are shown on the Wrench tab).*
5. In the *Calibrations* list, select Yield:



6. Follow the steps to perform the calibration.
7. Highlight the arrow and press the *Confirm* switch on the armrest.

Updating the Moisture Sensor (60 Series combines only)

Downloading Version 1.20C from Stellar Support

1. Go to www.stellarsupport.com.
2. Select *Support & Downloads* in the left column.
3. Select *Greenstar System* update from the *Software Downloads* column.
4. Select the green box labeled *Download GSD4 Software*.
5. Select **Run** in the file download security warning.
6. Once the download is complete, choose the preferred language and press **OK**.
7. Follow the Greenstar Update Wizard to load the firmware to the keycard for the original Greenstar monitor.

Loading version 1.20C to the Moisture Sensor

1. Insert the updated keycard into the mobile processor that is hooked to the Greenstar display *(it does not matter which slot the keycard is inserted in on the mobile processor)*.
2. Power on the Greenstar monitor.
3. Press INFO
4. Select KeyCard
5. Select Program Target
6. Select Harvest Monitor Combine
7. Select PF347112J Version: 1.12J Moisture 1.12J
8. Disconnect the mobile processor after the update is complete.

CHAPTER

21

The Ag3000 Modem

In this chapter:

This chapter describes how to install and configure the Ag3000 modem to work with the FM-1000 integrated display.

Introduction to the Ag3000 modem

The Ag3000 modem enables the FM-1000 integrated display to receive RTK corrections from a Trimble VRS™ network, a third-party RTK provider or a Continuously Operating Reference Station (CORS).

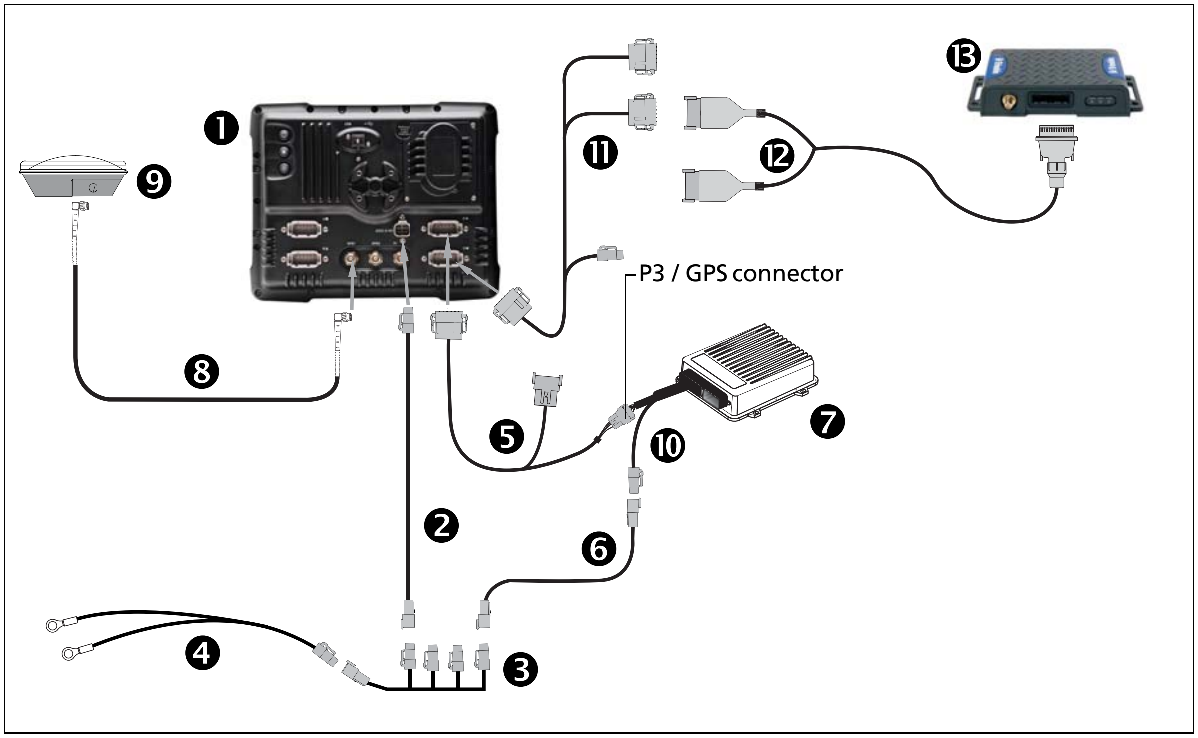
Benefits of using an Ag3000 modem

The benefits of using the FM-1000 integrated display and the Ag3000 modem include the following:

- More acres of RTK accuracy from Trimble VRS Now™ delivered to your display.
- Easy interface and configuration with the display.
- External cell modem GSM antenna for enhanced signal reception to minimize cell phone signal related drop outs.
- Three LEDs to indicate operation status.
- In North America, the Ag3000 modem is bundled with a SIM card (AT&T or Jasper Wireless) and a cell phone service plan.
- In Europe, the Trimble reseller will contact the local VRS Now provider for a SIM card and service plan, as this varies from country to country.

Connecting the Ag3000 modem

The following figure shows how to connect the FM-1000 integrated display to the Autopilot Automated Steering System while using corrections from the Ag3000 modem.



CAUTION – Connecting the Port Replicator on the FM-1000 to NavController II cable ❺ to the P4 or P12 connector of the NavController II harness ❿ will result in damage to the FM-1000 integrated display, and will void the warranty.

Item	Description	Trimble part number
❶	FM-1000 integrated display	93100-01
❷	FM-1000 power cable	66694
❸	FM-1000 power cable with relay and switch (power bus)	67259
❹	Basic power cable	67258
❺	FM-1000 to NavController II cable with port replicator	75741
❻	2 pin DTM to 2 pin DT power adaptor	67095
❼	NavController II	55563-00
❽	8m GPS TNC/TNC RT angle cable	76442
❾	AG25 GNSS antenna	68040-00S
❿	Main NavController II cable	54601
⓫	Ag3000 to FM-1000/FM-1000 cable	77273

Item	Description	Trimble part number
⓬	Ag3000 break-out cable	70433
⓭	Ag3000 modem	80300

Activating the Ag3000 modem

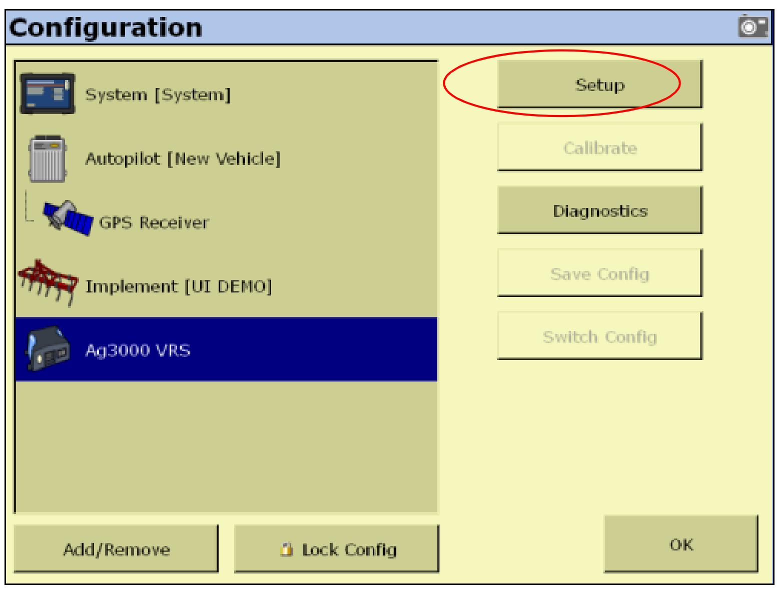
In the USA, the Ag3000 is bundled with a Trimble-installed AT&T or Jasper Wireless SIM card, which is tied to your Ag3000 unit and cannot be separated. You cannot use any other SIM cards with this device.

Additionally, this modem does not work in a CDMA network.

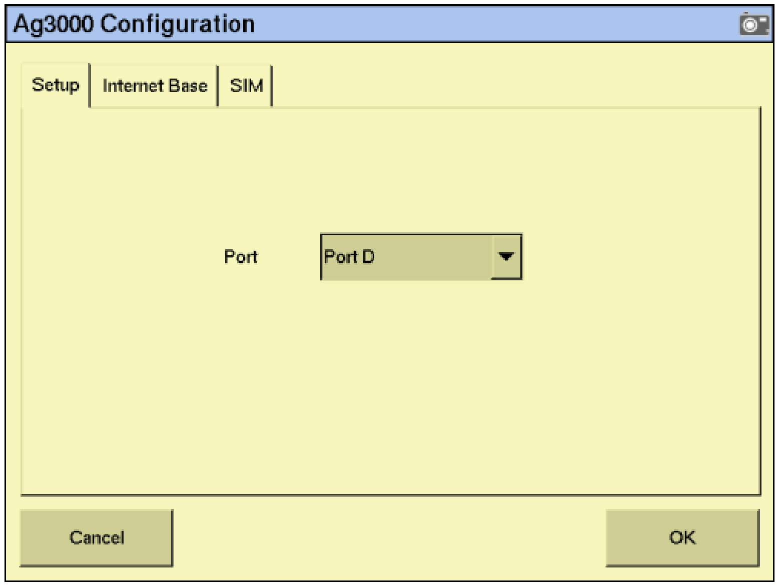
Outside of the USA, you must contact your local VRS Now or third-party cell provider for a SIM card.

Configuring the Ag3000 modem

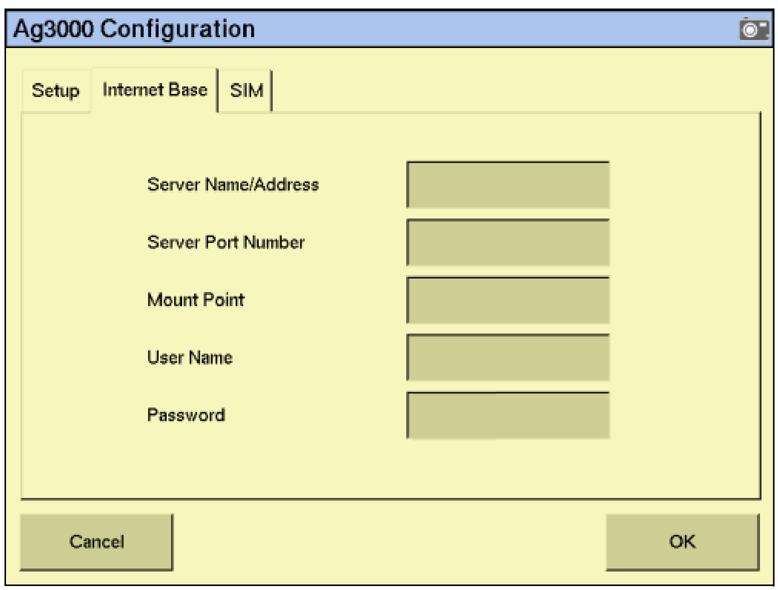
1. Install the Ag3000 plugin. For more information, see Adding or removing a plugin, page 194).
2. From the *Configuration* screen, select the *Ag3000 VRS* plugin and then tap **Setup**:



The *Ag3000 Configuration* screen appears:



3. From the *Port* drop-down list, select the CAN port that the Ag3000 modem is connected to. The default setting is *Port D*.
4. Select the *Internet Base* tab:



5. Enter the required settings, as provided by your Trimble VRS Now or Network RTK operator, as described below.

Internet base setting	**Description**
Server Name/Address	RTK/VRS/CORS base station broadcast name
Server Port Number	Base station port number
Mount Point	Base station mount point

Internet base setting	Description
User Name	Assigned username
Password	Assigned password

6. Tap **OK**. The *Configuration* screen appears.

The Ag3000 modem is now configured.

Note – *SIM tab fields:*
- In the USA, the Ag3000 modem has an AT&T or Jasper Wireless SIM card; you do not need to enter the details.
- Outside of the USA, you must obtain details of the SIM card from the card provider and then enter them.

CHAPTER

22

The EZ-Remote Joystick

In this chapter:

- Requirements
- Installation
- Enabling the EZ-Remote Joystick

This chapter describes the EZ-Remote joystick, which is a programmable, external device that controls the functions of the FM-1000 integrated display.

If you use the EZ-Remote joystick, you do not need to tap buttons on the FM-1000 integrated display. This improves your accuracy when you select buttons, and gives you faster reaction times.

Requirements

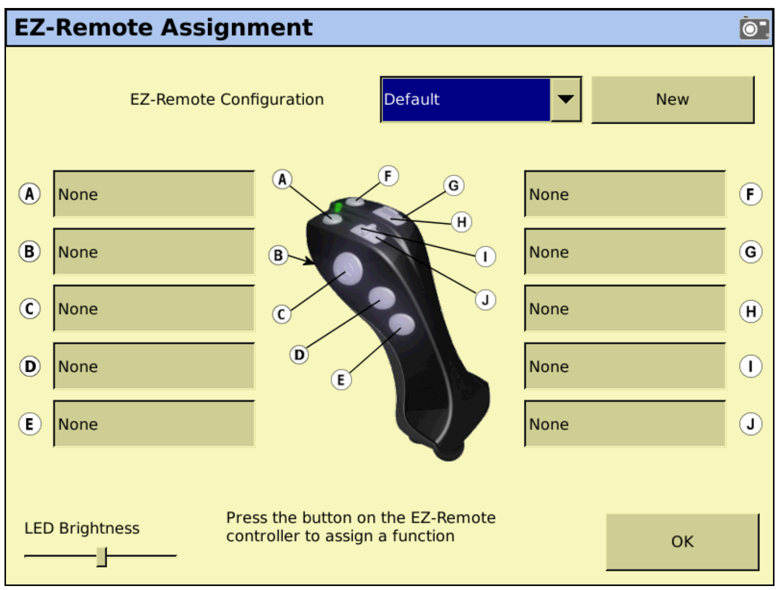
- FM-1000 integrated display
- EZ-Remote joystick

Installation

For installation information, see the EZ-Remote Joystick Quick Reference Card.

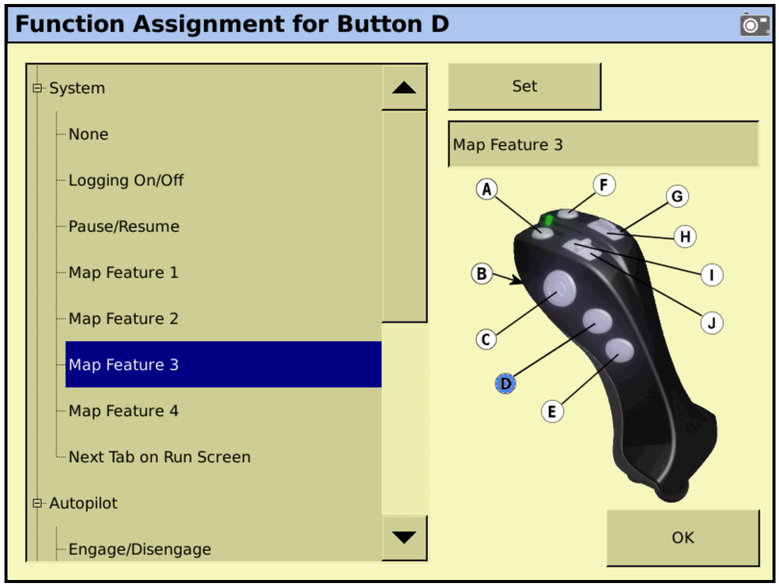
Enabling the EZ-Remote Joystick

1. Connect the EZ-Remote joystick into Port B on the back of the display. An EZ-Remote joystick icon automatically appears on the *Configuration* screen.
2. From the *Configuration* screen, select *EZ-Remote* and then tap **Setup**. The *EZ-Remote Assignment* screen appears:

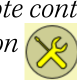


3. In the *EZ-Remote Assignment* screen, you can configure each key for the function you want to control remotely. You can also adjust the brightness of the LED joystick buttons.

4. On the EZ-Remote joystick, press the first button you wish to program. The Function Assignment screen appears:



5. Tap the feature that you want to program into that button on the control joystick.
6. Tap **Set** and then tap **OK**. The *Keypad Assignment* screen appears again.
7. Repeat Step 3 through Step 6 to program more buttons as required.
8. When completed, tap **OK**.

***Note** – You can configure the EZ-Remote control joystick while operating in a field. From the Run screen, tap the Configure button*  *and then follow the steps above.*

***Note** – The functions available to assign to each button depend on which plugins are activated on the FM-1000 integrated display.*

CHAPTER

23

The LB25 External Lightbar

In this chapter:

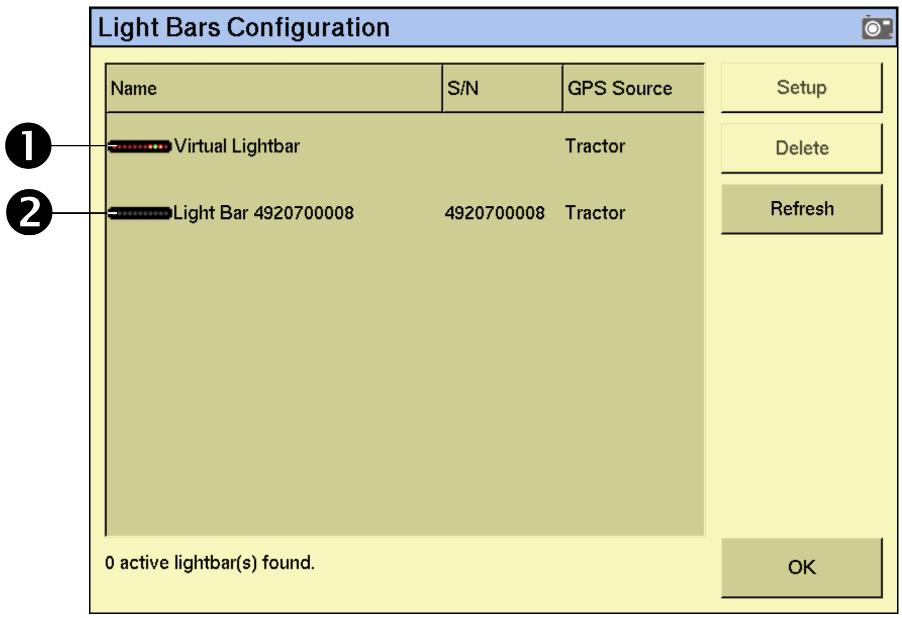
- Configuring the lightbar

This chapter describes how to configure the LB25 external lightbar to operate with the FM-1000 integrated display.

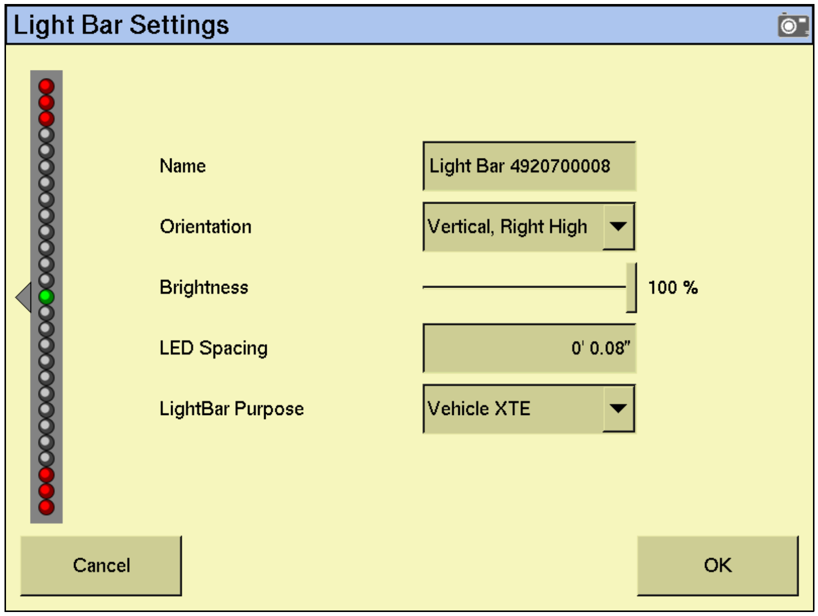
Configuring the lightbar

1. Connect the LB25 lightbar to port B on the rear of the FM-1000 integrated display.
2. From the Home screen, tap .
3. In the *Current Configurations* screen, tap **Configure**.
4. Select the System option and then tap **Setup**.
5. From the *Display Setup* screen, select *Lightbar* and then tap **Setup**.

   In the *Light Bars Configuration* screen the virtual lightbar from the FM-1000 integrated display is shown ❶, along with any detected external lightbars ❷:



6. Select an external lightbar and then tap **Setup**:



7. Enter the required settings and then tap **OK**. The *Light Bars Configuration* screen appears.
8. Tap **OK**.

The external lightbar is now configured.

CHAPTER

24

Advanced Configuration

In this chapter:

Once you complete the basic configuration, you can:

- Use this chapter to configure more advanced features for higher accuracy or better performance.
- Begin driving. See Getting Started.

***Note –** Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the Home button. When the display prompts you to close the field, tap **Yes**.*

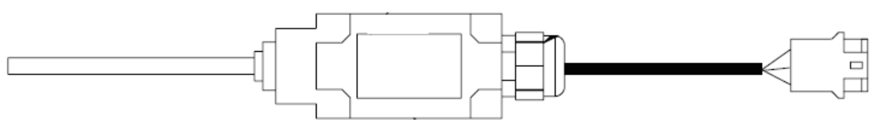
Configuring remote coverage logging

You can configure the FM-1000 integrated display to control coverage mapping by using a switch on the implement instead of the button on the Run screen.

Installing the logging option

To connect an implement switch to the FM-1000 integrated display and configure the display to use the switch to control the logging do the following:

1. Install a switch on the implement to allow for correct switch activation when the implement is raised or lowered. For example, a switch similar to the Trimble P/N 60477S (shown below), can be used to activate the coverage logging:



SIGNAL	SWITCH	COLOR	SHROUD
5V	13	GREEN	A
SIGNAL	14	BLACK	B
	N/C	RED	C

The switch must make and break the connection on pins 10 and 11 on the FM-1000 port connector.

For example, to use the 60477S switch:

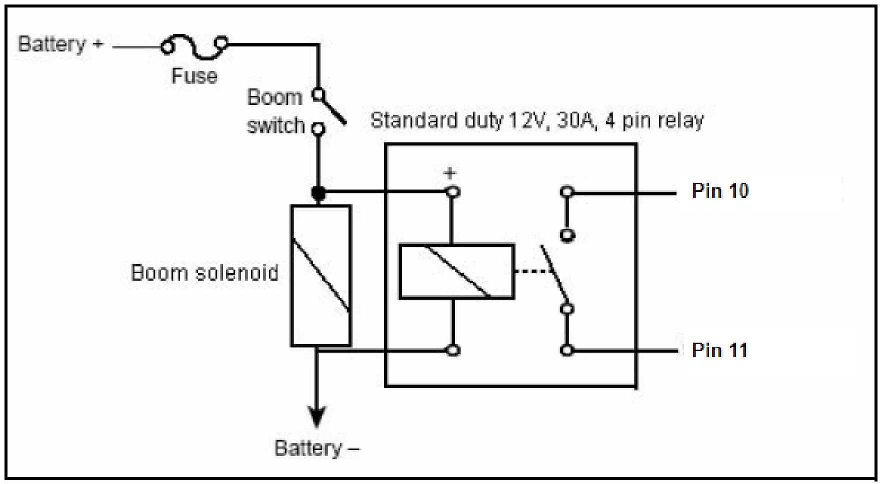
a. Connect pin A of the switch to pin 10 of the 12-pin Deutsch connector on Port A or Port B of the display.

b. Connect pin B of the switch to pin 11 of the 12-pin Deutsch connector on Port A or Port B of the display.

Doing this results in the connection being made between pins 10 and 11 of Port A or B of the display when the implement is raised or lowered.

Notes – *If Ports A or B are used by other cabling, you can use the port replicator on the cable to connect the remote logging switch.*
– If you use a different switch, the connections may be different than described in this example.

A relay must be used to control coverage logging when voltage is present at the switch. The following schematic shows the relay between the display and the switch:



For more information on configuring the implement, see Adjusting the implement settings, page 178.

Enable the external switch

To enable the external switch:

1. From the Home screen, tap .
2. Tap **Configure**.
3. Select the implement and then tap **Setup**.
4. Select the *Extras* tab.
5. In the *Remote Log Switch* list, select either Connector A or Connector B.
6. In the *Logging When* list, select either High or Low:

Item	Description
Logging when high	The system records logging when the switch is turned on and stops recording when the switch is turned off.
Logging when low	The system records logging when the switch is turned off and stops recording when the switch is turned on.

Note –** When remote logging is set to Connector A or Connector B, the* ***Logging *button on the Run screen is disabled. Use the external switch to turn logging on or off.*

Changing the password

***Note –** To change the Administration password, you require the Master password. If you do not know it, contact your local Trimble reseller. See also* *Password access, page 81**.*

1. Do one of the following:
   - If you have not entered the password during the current session, tap **Setup** or **Calibrate** from the *Configuration* screen.
   - If you have already entered the password during this session, tap the Home button and then tap **Lock Configuration**. On the *Configuration* screen tap **Setup** or **Calibrate**.

   The *Enter Administration Password* screen appears.
2. Enter an ***incorrect*** password. The *Wrong Password* screen appears.
3. Tap **Enter Master Password**.
4. Enter the Master password and then tap **OK**. The *Change Administration Password* screen appears.
5. Enter your new Administration password in both fields.

The new Administration password is now active.

Locking the display (to re-enable the password)

To re-enter the password if you have already entered the Administration Password:

1. From the Home screen, tap .
2. Tap **Configure**.
3. Tap **Lock Config**.
4. Tap **Setup** or **Calibrate**. The *Enter Administration Password* screen appears.

Saving the vehicle configuration

***Note –** The vehicle configuration is different from the display and implement configuration. The vehicle configuration saves the Autopilot vehicle settings that you **created**. The display configuration saves the display appearance features that you **selected**, and the implement configuration saves each implement including plugins and physical attributes.*

1. From the *Configuration* screen, select the Autopilot option and then tap **Setup**. The *Vehicle Controller Setup* screen appears.
2. Edit the vehicle settings and tap **OK**.
3. Tap **Save Config**.
   - To overwrite a previous configuration file, tap **Switch Config** and then select the previous file from the *Vehicle Configuration* list.

4. To save the file, tap **OK**.
5. Tap **Save Config**.

   Before the configuration file is saved, the following message appears:

   You are about to overwrite the existing Vehicle Configuration. Do you want to Save or create a New Configuration. Tap either Save to overwrite or New to create a new configuration file.

Saving a PDF version of the current field

When you close a field, the system automatically creates a PDF summary file. The PDF is saved to the *\AgGPS\Summaries\<client_farm_field_event>* folder:

Trimble
Event Summary

Smith_Ranch
Farm3
ne2-8-33
STRIPTILL

Event Details	
Operator	
Event Created	2008-Apr-05 19:03:21
Summary Created	2010-Oct-05 21:55:27
Latitude/Longitude	39°23'21.48"N 100°57'39.60"W
Field Area	0.00 a
Total Boundaries Area	0.00 a
Total Time	14hr 42m
Operator EPA License	
Harvest Year	
Farm Location	
Crop	
Material	
Target	
Application Method	

Coverage Layers	
Layer 1 - UNKNOWN	
Coverage Time	7hr 21m

Equipment	
Vehicle	Not Available
Implement	UI DEMO
Implement Width	40' 0" [Offset 0' 0"]
Application Width	5' 0"
Rows	16

NOTE:
Totals are approximate values and may not be acceptable for customer invoice.Consult local laws and regulations for customer invoicing procedures - some regions require official weighing.

The Event Summary file may include the following images of the field:

This image ...	Shows the ...
Overlap	coverage and any overlaps
Height	vertical height of the GPS position
Applied rate	volume at which the spray boom applied solution
GPS quality	quality of the GPS signal
Average XTE coverage layer	degree of implement drift

The file also shows information about:

- The event
- The vehicle setup

Tap the appropriate buttons to show or hide coverage area and/or area features. If any Prescriptions are available, a prescriptions button is also available.

To view a summary report on an office computer:

1. Remove the CompactFlash card from the display and then insert it into an office computer.
2. Select the folder *\AgGPS\Summaries* and then open the file Index.html.
3. Select the appropriate field from the list.

***Note** – If you use the Microsoft® Internet Explorer® internet browser, you may need to allow ActiveX® technology to see all of the summary file.*

Upgrading the FM-1000 integrated display firmware

1. Transfer the new firmware file from www.trimble.com to your office computer.
2. Connect the FM-1000 integrated display USB memory stick to your office computer.
3. Unzip the firmware file and then save it to the root folder of the USB memory stick.
4. Insert the USB memory stick into the USB socket on the rear of the FM-1000 integrated display.
5. Press the Power button on the rear of the display to turn on the FM-1000 integrated display and then wait for the Home screen to appear.
6. Tap **Upgrade**. The *Firmware Upgrade* screen appears.
7. Select a firmware file from the *Firmware* list and tap **Upgrade**.
8. Once the upgrade is complete, tap **OK**. The system restarts.

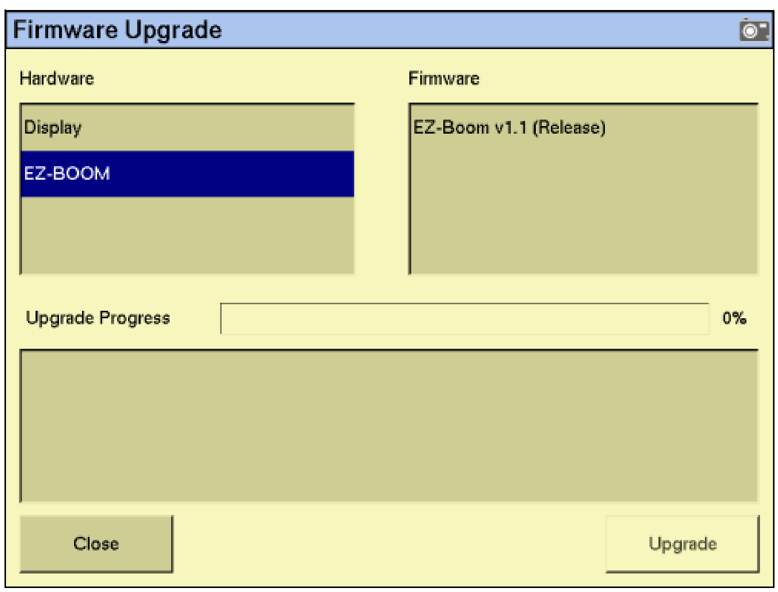
Upgrading the EZ-Boom controller or Multi-Application firmware

You can use the display to upgrade the firmware in the following components:

Plugin	Item
EZ-Boom	EZ-Boom controller
Tru Application Control	Working Set Master Module (WSMT)
Tru Application Control	Tractor ECU

To upgrade a component's firmware:

1. Transfer the new firmware file from www.trimble.com to your office computer.
2. Connect the FM-1000 integrated display USB memory stick to your office computer.
3. Copy the firmware upgrade file to the *Firmware* folder on the USB memory stick.
4. Insert the USB memory stick into the USB socket on the FM-1000 integrated display.
5. Press the Power button on the rear of the display to turn on the FM-1000 integrated display and then wait for the Home screen to appear.
6. Tap **Upgrade**:



7. Select the appropriate plugin from the *Firmware* list. Any available firmware upgrade files appear in the lower left list.
8. Select the appropriate firmware file.
9. Once the upgrade is complete, tap **OK**. The system restarts.

The component's firmware is updated.

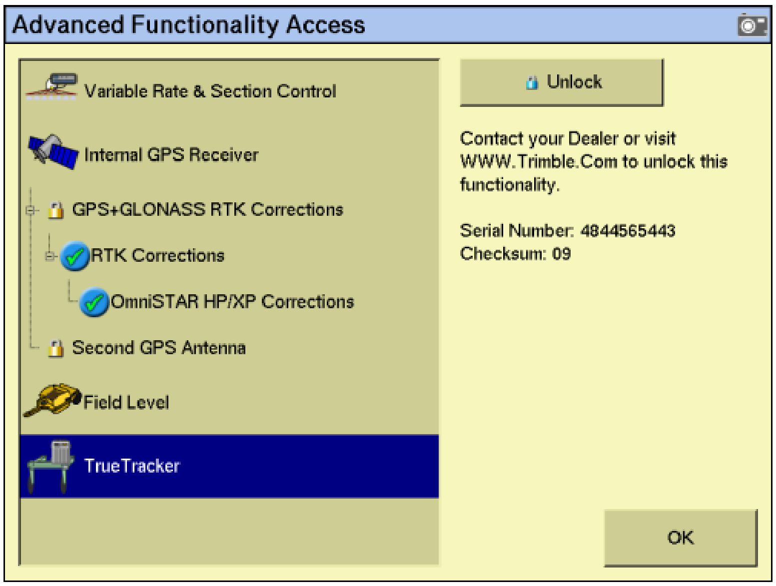
Unlocking additional devices

You can purchase enhanced features for the FM-1000 integrated display from your local Trimble reseller.

Note – *When you purchase an EZ-Boom or Tru Application Control system, you receive a text file containing the unlock password. Place this file in the \AgGPS\Firmware\ folder on the CompactFlash card. You can now skip the following steps.*

To enable the additional features, do the following:

1. Turn on the FM-1000 integrated display. The Home screen appears.
2. Tap **Unlocks**:



3. Tap the button for the feature that you want to unlock. The *Enter Password to Activate* screen appears.
4. Enter the password and then tap **OK**. The feature is enabled. The password is saved to the card for future use.

CHAPTER

25

Data Management

In this chapter:

This chapter describes the files and folders on the FM-1000 integrated display USB memory stick.

Transferring data to an office computer

All field data collected by the FM-1000 integrated display is saved onto the USB memory stick.

To transfer data to an office computer:

1. Remove the USB memory stick from the FM-1000 integrated display.
2. Insert the USB memory stick into your office computer.

CAUTION – If you place the files in a series of folders, the combined filename and folder path may become too long and the operating system may not allow you to open the files. To avoid this, Trimble recommends that you place data in your computer's C:\ folder.

3. Copy the appropriate folder to the office computer using an application such as Windows® Explorer. This copies all the sub-folders and files in the folder.

***Note** – When you copy or move files using Windows Explorer, you must keep all the shape-files (.dbf, .shp, and .shx) together so that office software can open the theme file. To ensure that the files stay together, always copy the entire folder rather than just the individual files.*

If you create a new event in a field, and you already have the *\Field* folder containing any previous events on the office computer, you should still copy the *\Field* folder so that the new EventHistory information is copied across.

CAUTION – If you use the same farm, field, or event names on more than one display, you could accidentally overwrite existing files when you copy data to the office computer. To prevent this, create a separate folder for each unit. For example:
C:\AgGPSFMD_SN123456\
C:\AgGPSFMD_SN123457\
C:\AgGPSFMD_SN123458\

Data formats

The FM-1000 integrated display uses the Environmental Systems Research Institute (ESRI) 3D shape-file format for storing the layers of graphical information collected in the field (for example, spray coverage, track logging points, and features). The three files in a shapefile "set" are:

- The <*filename*>.dbf file, which contains the feature attributes.
- The <*filename*>.shp file, which contains position information.
- The <*filename*>.shx file, which is an index file that links the position information with its attributes.

In this manual, the term ***shapefile*** is used to refer to the three files collectively.

The FM-1000 integrated display records all latitude, longitude, and height data in decimal degrees.

Note – *The FM-1000 integrated display reads and writes ESRI ArcView version 2.0 or 3.1 3D polylines, polygons, and points. The M and Z entity types introduced in ArcView 3.1 can be generated in the track logging files, but cannot be read by the FM-1000 integrated display. For more information, go to the ESRI website (www.esri.com).*

Editing files

ESRI shape (.shp) and attribute (.dbf) files can be used in many other software packages that can import or use .shp and .dbf formats.

Trimble recommends the Farm Works® software. For more information, go to www.farmworks.com.

Data collected by the FM-1000 integrated display can be opened directly into the Farm Works software. You can make changes to the files and save them on an office computer.

Do not save changes back to the USB memory stick as this could mean that you cannot select the field with the FM-1000 integrated display.

The Microsoft Excel® spreadsheet software and most database software also let you open and view the data in the attribute (.dbf) file.

Generating files in the office

The FM-1000 integrated display can load files that you created in office software. Save Shapefile or Agfile (.gdx) prescriptions to the *\AgGPS\Prescriptions* folder on the card to send rates to a variable rate controller.

Folders on the USB memory stick

This list shows:

- The names and types of files containing mapping and logging information.
- The folder where the FM-1000 integrated display saves these files on the USB memory stick.

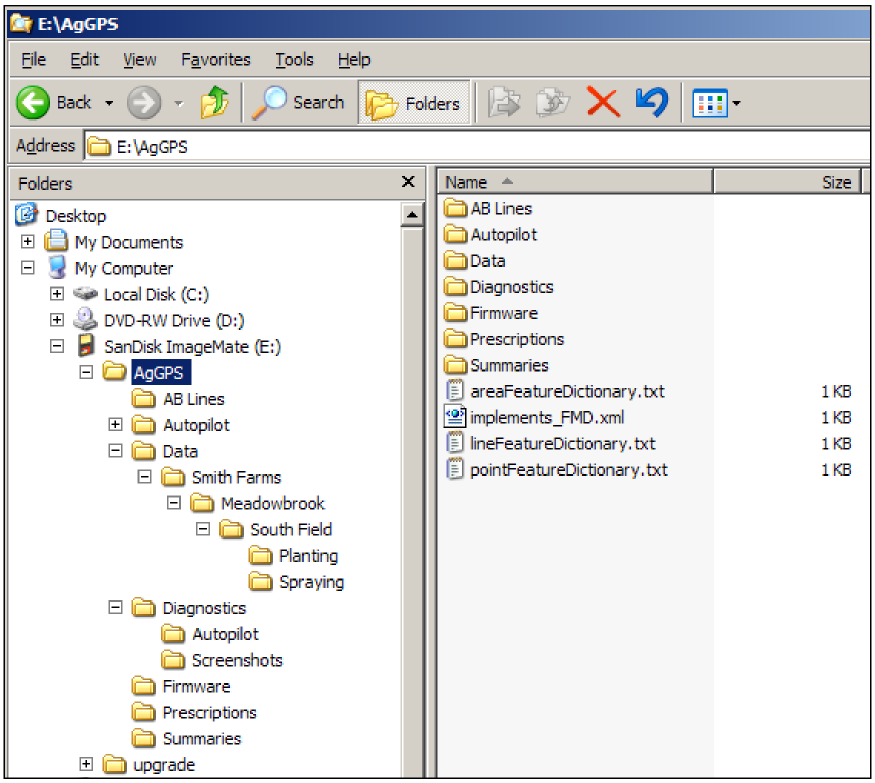
Data	Description	Files	folder
Field AB Line	Boundary and/or AB Lines polylines	Swaths.shp Swaths.dbf Swaths.shx	*Field*\\ For more information, see Field folder, page 620.
Field boundary	Polygon	Boundary.shp Boundary.dbf Boundary.shx	
Event history	Event information	EventHistory.dbf	
Point features	Attribute ID and latitude, longitude, and height	PointFeature.shp PointFeature.dbf PointFeature.shx	
Line features	Line with attribute ID	LineFeature.shp LineFeature.dbf LineFeature.shx	
Area features	Area polygons with attribute ID	AreaFeature.shp AreaFeature.dbf AreaFeature.shx	
Coverage	Series of polygons	Coverage.shp Coverage.dbf Coverage.shx	*Event*\\ For more information, see Event folder, page 622.
Track	Series of 3D points with attributes	Track3D_<*date time*>.shp Track3D_<*date time*>.dbf Track3D_<*date time*>.shx	
Summary	HTML	<*eventname*>_Summary.txt	*AgGPS**Summaries*\\<*Client_Farm_Field_Event*>\\ For more information, see Event folder, page 622.

Data	**Description**	**Files**	**folder**
Diagnostic	Folder files	ProgramLog.txt ProgramLog.old (FM-1000 integrated display logs) FaultLog.txt (Autopilot faults) EZ-BoomFaultLog.txt (EZ-Boom faults) service messages messages_.gz messages_.gz.1...9 (Operating system logs) core.gz (Debug data) <*Date*>	\Diagnostics\
Yield	Yield points with attribute ID	TaskData.xml TLG<xxxxx>.bin TLG<xxxxx>.bin	\TaskData\
	Autopilot config	Vehicle.cfg	\Diagnostics\Autopilot\
	System settings	<*Preferences*>.xml	\Diagnostics\Preferences\
	–	Screenshot_<*num*>.png	\Diagnostics\screenshots\

The *Ag*GPS folder

The *\AgGPS* folder stores system utility files and subfolders that contain the input and output files of the FM-1000 integrated display. See Prescriptions, page 73 and Folders on the USB memory stick, page 616.

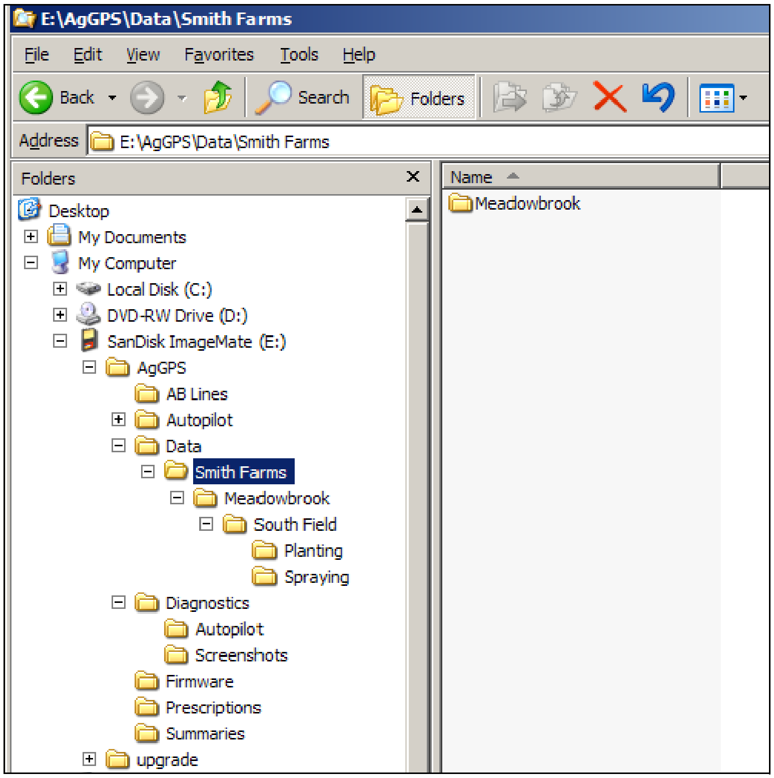
The following diagram shows system utility files and the data folders in the *\AgGPS* folder saved on a USB memory stick by the FM-1000 integrated display:



Client folder

The *\Client* folder stores a sub-folder for each farm defined for the client.

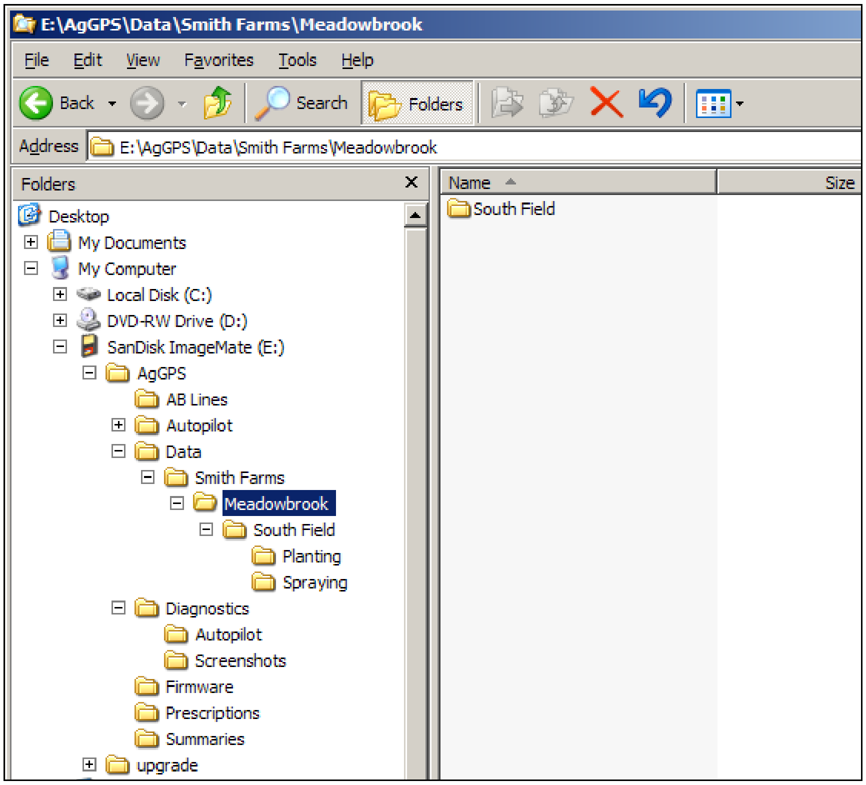
The following diagram shows the *\Client* folder and file organization:



Farm folder

The *Farm*\ folder stores a subfolder for each field defined for the farm.

The following diagram shows the *Farm*\ folder and file organization:

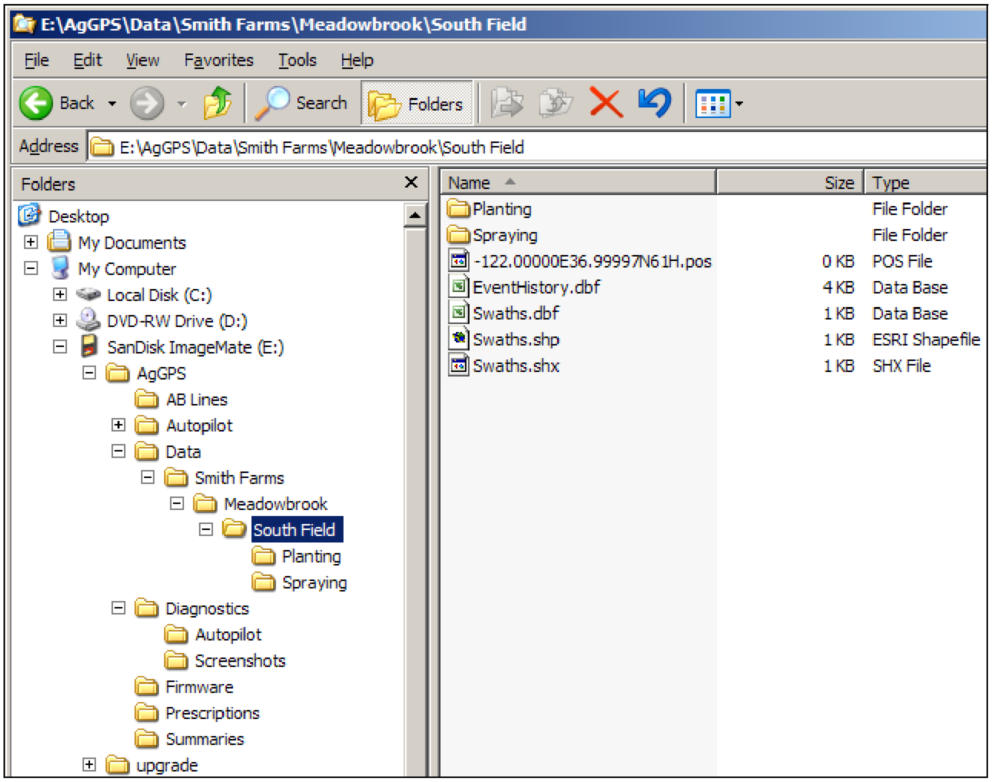


Field folder

Each *Field*\ folder stores:

- A subfolder for each event performed on the field. See Event folder, page 622.
- Three Swaths files.
- If it is a bounded (headland) field, three Boundary files. See Field boundary and AB Line files, page 622.
- An empty file whose name represents the coordinates of the field boundary file (for example: 172.000E43.000S12H.pos locates the boundary at latitude 172.000 East, longitude 43.000 South, and altitude 12 m high).
- Any recorded features files. See Features files, page 625.
- Any paused files. See Pausing guidance, page 68.
- The field event history file: EventHistory.dbf. It contains information about each event carried out in the field. See Event History file, page 625.

The following figure shows how a *Field*\ folder and its files are organized:

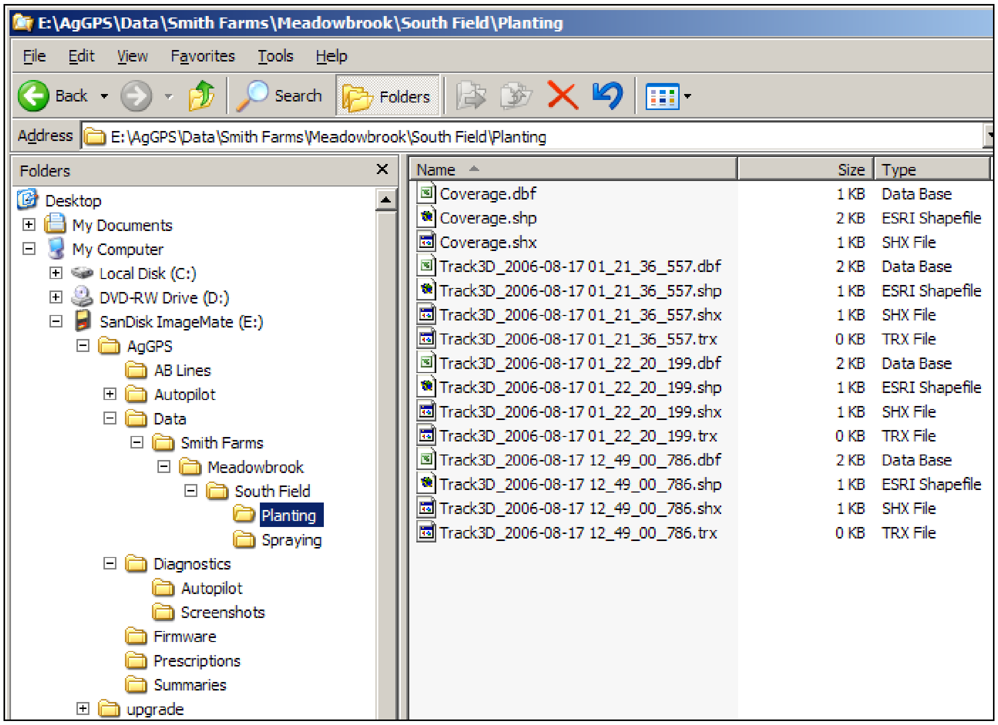


Event folder

Each *\Event* folder stores:

- Coverage logging shapefiles that are recorded during the event, called Coverage.*. See Coverage logging data, page 623.
- Track logging shapefiles that are recorded during the event, called Track3D_<*date time*>.*.

The following figure shows how an *\Event* folder and its files are organized:



TaskData folder

The TaskData directory contains yield data collected in the ISO11783 BIN format, which is read by Farm Works and other precision Agriculture software titles.

Files on the USB memory stick

Field boundary and AB Line files

There is one set of boundary and AB Line shapefiles for each field called:

- Boundary.*
- Swaths.*

Information stored in the Boundary.shp file for fields with boundaries includes a boundary polygon. Fields without boundaries do not contain a boundary file.

Information stored in the Swaths.shp file for fields with boundaries includes AB polylines.

Units are always metric in files created by the FM-1000 integrated display.

The following information is stored in the boundary and ABLine attribute files.

Column	Field description	Notes
Date	Date the field was created	YYYYMMDD
Time	Field creation time (local time, am/pm format)	hh:mm:ss
Version	Boundary or ABLine attribute file version	
ID	AB Line number ID	
Name	Name assigned to the AB Line	
Area	Field area (Boundary area)	ha
Perimeter	Field perimeter distance (Boundary only)	meters
Length	Length of the AB Line	meters
SwathsIn		
Dist1		
Dist2		
PrefWeight		

Unless a field has a boundary, the size of the field is not defined. Therefore, for fields without boundaries the *%_Complete* in the EventHistory.dbf file is always zero.

***Note** – If you browse the .dbf files using an Excel spreadsheet, date fields may appear in a different format, depending on your local settings.*

Coverage logging data

Coverage logging files are created when any application coverage is recorded. For each coverage-polygon, the following information is saved to the coverage logging file.

Column	Field description
Version	Coverage attribute file version
GPS_Status	Numeric GPS status value
Status_Txt	GPS status description
Swath	The current swath number when coverage was recorded
Height	Height in meters
DateClosed	Date the polygon was closed
TimeClosed	Time the polygon was closed
AppliedRate	Applied rate reported by the variable rate controller
Speed	Average GPS ground speed for the polygon (in meters per second)
XTE	Implement Cross Track Error (in meters)
AppType	Application type ID

Track logging files

Track logging files are created whenever the event is opened. See Track logging files, page 86. At each point, a number of attributes are recorded.

The units stored in the track attribute file (Track3D_<*date time*>.dbf) are in metric units.

The following information is stored for each point, in the track logging attribute file.

Column	Field description	Units/notes
TRACK_ID	Date and time stamp	–
Version	Track attribute file version	–
UTC_Date	Point creation date	YYYYMMDD
UTC_Time	UTC time	hh:mm:ss.s
Local_Time	Local time	hh:mm:ss.s
Logging_On	Coverage logging Flag (1=on, 0=off)	On or off
Auto_Steer	Auto-Steer Flag (1=on, 0=off)	On or off
GPS_Status	GPS status value	1 to 12
Status_Text	GPS status description	–
Num_Stats	Number of GPS satellites	–
DOP	Horizontal Dilution of Precision – a measure of the quality of positions based on satellite geometry	–
Corct_Age	DGPS signal correction age	seconds
Ant_Lat	Antenna latitude (WGS-84)	DD.ddddddd
Ant_Long	Antenna longitude (WGS-84)	DD.ddddddd
Height	Mean sea level height of ground	meters
Ant_HAE	Antenna height above ellipsoid	meters
Ground_HAE	Ground height above ellipsoid	meters
Speed	GPS derived ground speed	kph
Heading	Direction of travel with respect to true North.	decimal degrees
Swath_Num	Current swath/headland number.	
Offline	Offline distance from swath center line.	meters
Along_Line	Along Line distance from start of swath.	meters
Swath_wdth	Swath width	meters
Appln_Wdth	Application width	meters
Units	Units	metric
Field_Name	The name of the field	–
Target	The target rate at the current position	–
Pitch	The pitch	–
Roll	The roll	–
Yaw	The yaw	–
Target	The target application rate when serial rate control, TAC or Field-IQ are used.	

Column	Field description	Units/notes
As applied	The actual rate applied by the rate control system when serial rate control, TAC or Field-IQ are used.	
NDVI	The NDVI values recorded when using the GreenSeeker plugin.	
	***Note –** Not currently implemented.*	
Total_Qty	Total volume of material as applied for the current field. Only supported for the Aerial Flow Controller, Autocal Flow controller, and Crophawk Flow Meter.	–
Relative_Height	Height	meters

Event History file

The EventHistory.dbf file contains information on every event carried out in the field:

Data	Description
Version	FM-1000 integrated display firmware version
Client	Client name
Farm	Farm name
Field	Field name
Event	Event name
Operator	Operator name
Material	Material name
Date open	Date the field was opened
Time open	Time the field was opened
Date close	Date the field was closed
Time close	Time the field was closed
Duration	Length of time that the field was open (seconds)
PrimaryAB	Number of the primary AB Line
ABLine	
Cover area	Area covered
Cover distance	Distance covered
Cover time	
Engage time	Time engaged

Features files

When features are recorded in the field, each type of feature is saved in three feature shapefiles in the *\Field* folder as follows:

These features...	Are saved in these files...
Point	PointFeature.*

These features...	Are saved in these files...
Line	LineFeature.*
Area	AreaFeature.*

One row of data is stored in the <*type*>.dbf file for each feature of that feature type recorded in the field. The following information is stored in the <*type*>.dbf file for each feature.

Column	Field description	Notes
Date	Date the feature was created.	yyyy/mm/dd
Time	Time the feature was recorded.	hh:mm:ss.s
Version	Features attribute file version.	
ID	Feature ID	
Name	Feature name	
Area	Field area (Area only)	ha
Perimeter	Field perimeter distance (Area only)	meters
Length	Length of the AB Line.	meters
SwathsIn		
Dist1		
Dist2		
PrefWeight		
Only recorded in point features:		
Latitude	Antenna latitude	decimal degrees
Longitude	Antenna longitude	decimal degrees
Height	Ground mean sea level height at antenna position. If you are mapping on a slope, the height may be wrong.	meters
AlarmRad	Alarm radius	meters
WarningRad	Warning radius	meters
Status_Txt	GPS status	meters

Program Log message file

The FM-1000 integrated display performs checks:

- when the display is turned on or off
- periodically, while running

This information is saved to the ProgramLog.txt file, which is in the *\AgGPS\Diagnostics* folder. When this file becomes larger than 1024 KB, it is backed up to a file called ProgramLog.old.

The ProgramLog.txt file may be useful for troubleshooting. The file can be read with a text editor such as Notepad.

Importing AB Lines or boundaries

The FM-1000 integrated display can load field boundaries and AB Lines, created by an *Ag*GPS 170 Field Computer, Remote Data Logger (RDL), or a Geographic Information System (GIS).

To load GIS boundaries, files must be in WGS-84 latitudes, longitudes, and heights in decimal degrees.

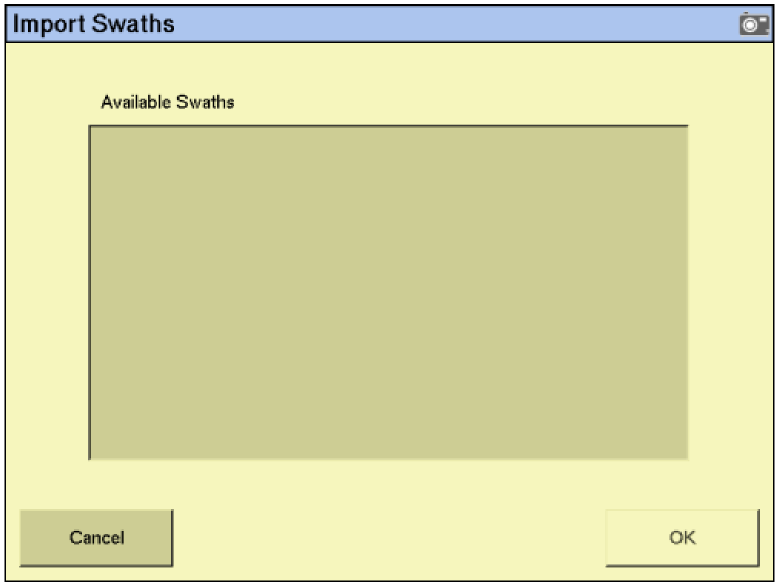
Use the following method to import an AB Line or a boundary into the FM-1000 integrated display:

1. Attach the USB memory stick to an office computer.

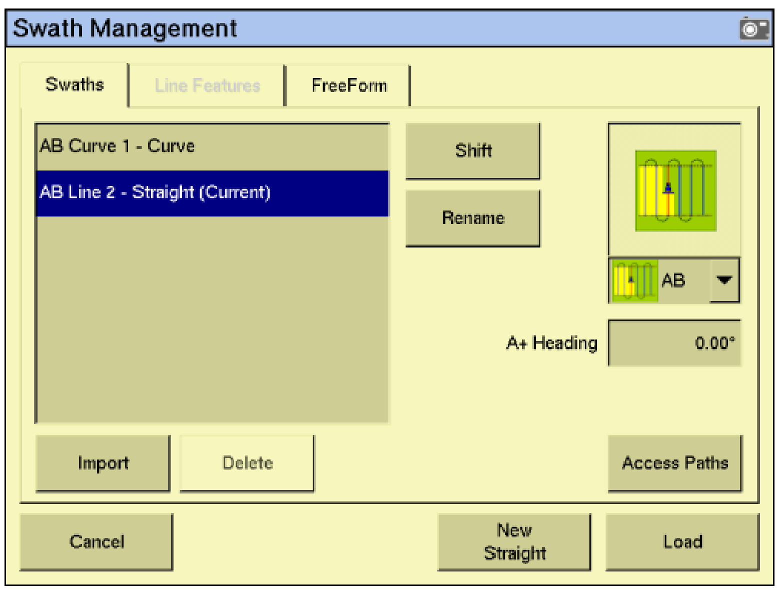
CAUTION – The three files that define a line or field (.shp, .shx, and .dbf) must have identical names. Otherwise, they are not recognized. If you put multiple sets of files in the folder, ensure that you do not have more than one set of files with each name or your files will be overwritten.

2. Copy the following files to the *\AgGPS\AB Lines* folder on the USB memory stick:
   – <field name>.shp
   – <field name>.shx
   – <field name>.dbf
3. Start the FM-1000 integrated display and then tap **Run**.
4. Do one of the following:
   – Open an existing field.
   – Start a new field.
5. Tap **Swaths**.

6. Tap **Import**:



7. Select the field or AB Line to import from the list of available swaths and then tap **OK**. The field or AB Line is imported:



If the AB Line file contains more than one AB Line, all AB Lines in the file are imported.

8. Select the AB Line that you want to use and then tap **Load**. A warning message appears.
9. Tap **OK**. The imported field or AB Line is ready to use.
10. For best results, close the field and then reopen it.

The Prescriptions folder

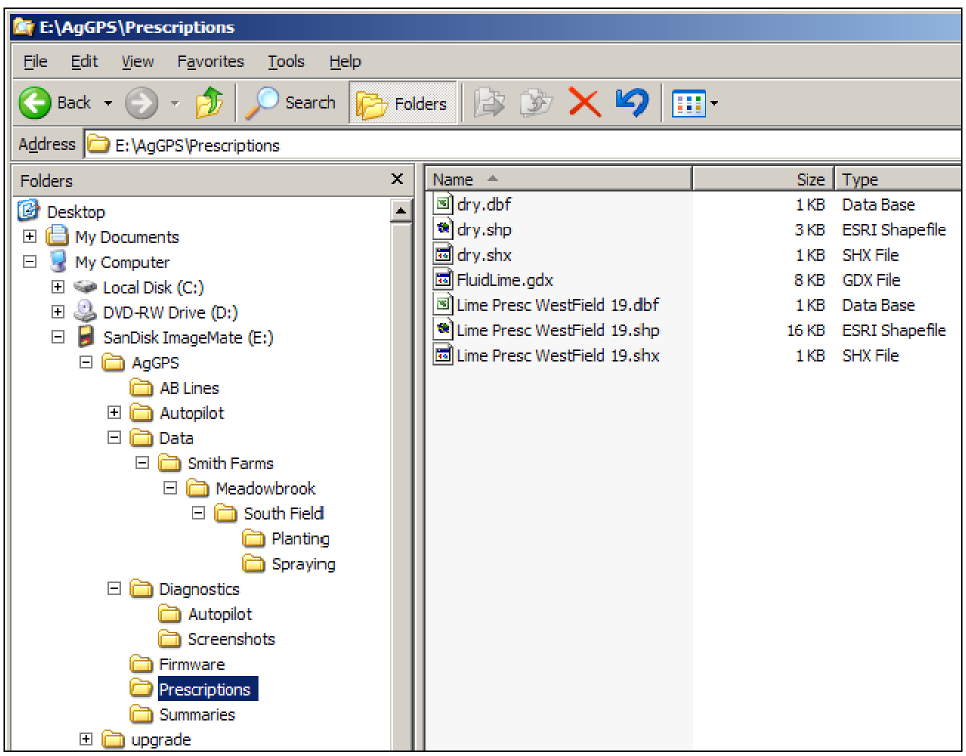
For each prescription that you generate, the *\AgGPS\Prescriptions* folder stores three prescription files in ESRI shapefile format, or a single .gdx file.

The shapefiles required are the .dbf, .shp, and .shx files. Some GIS software packages generate other files and include different contents in the files; if they are on the USB memory stick, they are ignored.

The names and types of files that are used to supply input information to the FM-1000 integrated display, and the folder where these files must be located on the card, are as follows.

Data	Description	Files	folder
Prescription files	Polygons ESRI shapefiles AgInfo GDX	*<prescriptionname>*.shp *<prescriptionname>*.dbf *<prescriptionname>*.shx *<prescriptionname>*.gdx	*\AgGPS\Prescriptions* For more information, see Prescriptions, page 73.

The following figure shows the contents of a *\Prescriptions* folder:



Copying or deleting data files

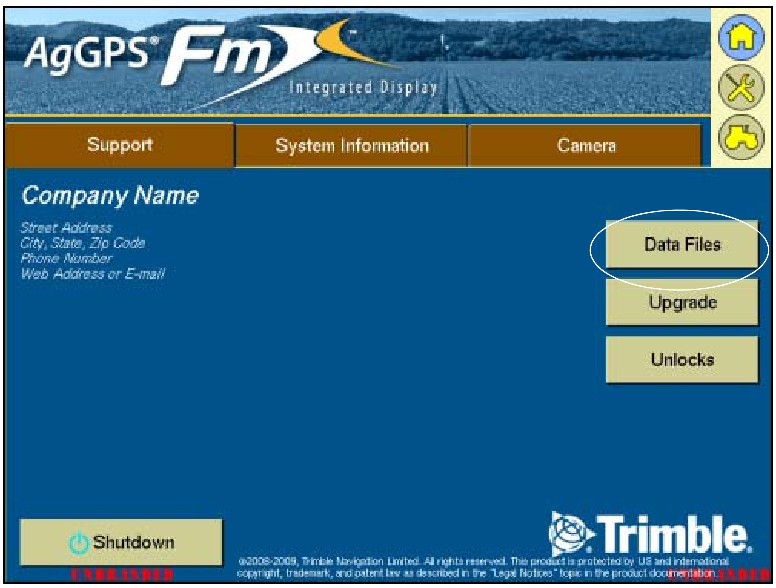
The *Data Files* screen enables you to copy or delete card data. It shows the fields, varieties, prescriptions, and data dictionaries that are in the internal memory and on the USB memory stick.

On the FM-1000 integrated display, there are two methods to access the *Data Files* screen. See the following sections:

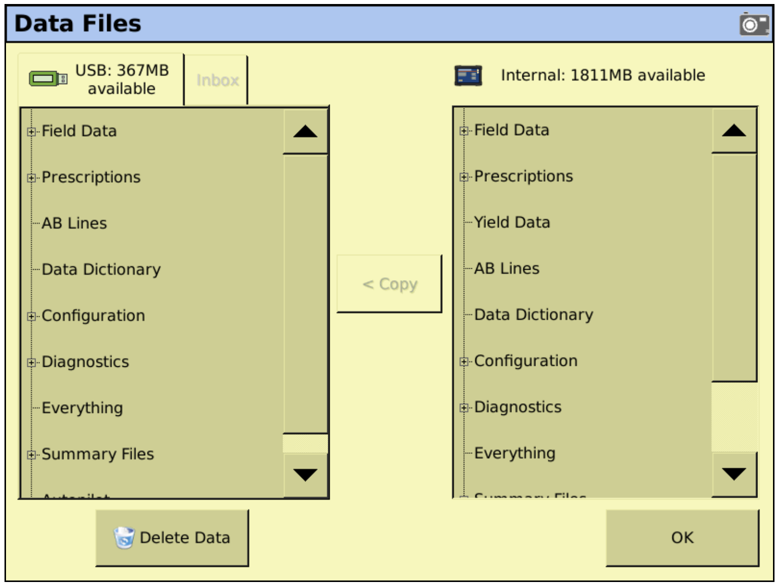
- Accessing data files from the Home screen, page 630
- Accessing the data files through the Configuration screen, page 631

Accessing data files from the Home screen

1. From the Home screen, tap **Data Files**:



The *Data Files* screen appears:



Accessing the data files through the Configuration screen

1. From the Home screen, tap .
2. On the *Current Configurations* screen tap **Configure**.
3. On the *Configuration* screen select System and then tap **Setup**.
4. If necessary, enter the administration password and then tap **OK**.
5. Select *Data Files* from the list and then tap **Manage**. The *Data Files* screen appears.

Copying data

To copy data from the USB memory stick to the internal memory or from the internal memory to the USB memory stick:

1. From the list, select the item to copy:
   – If the item is in the *USB* list, the **< Copy** button becomes available.
   – If the item is in the *Internal Storage* list, the **Copy >** button becomes available.
2. Tap **Copy**. The data is copied to the other column.

To copy data from the current USB memory stick (the source) to another USB memory stick (the destination):

1. Copy all of the data from the source to the internal memory.
2. When copying is complete, remove the source from the USB slot and then insert the destination.

3. Copy all of the data from the internal memory to the destination.

Deleting data

If you need to create more space, you can use the FM-1000 integrated display to:

- Delete any unused clients, farms, fields, events, or all of the data in the internal memory
- Delete any unused clients, farms, fields, events or all of the data on the USB memory stick

Deleting selected data from the internal memory

CAUTION – Deleting data is permanent. You cannot undo the deletion or restore the data.

1. From the *Configuration* screen, select System and then tap **Setup**.
2. If necessary, enter the administration password and then tap **OK**.
3. Select *Data Files* from the list and then tap **Manage**. The *Data Files* screen appears.
4. Tap **Delete Data**. The *Delete Data Storage* screen appears.
5. In the *Delete Data* storage tabs, select Internal Memory and then select *Field Data* from the list of available data types.
6. In the *Client, Farm Field* or *Event* drop-down lists, select the item to delete and then tap **Delete**.
7. When prompted, tap **Yes**. The data in the internal memory is deleted.

Deleting all of the data from the internal memory

CAUTION – Deleting data is permanent. You cannot undo the deletion or restore the data.

1. From the *Configuration* screen, select *System* and then tap **Setup**.
2. If necessary, enter the administration password and then tap **OK**.
3. Select *Data Files* from the list and then tap **Manage**. The *Data Files* screen appears.
4. Tap **Delete Data**. The *Delete Data Storage* screen appears.
5. Tap *Delete All Events,* or *Delete Everything*.
6. When prompted, tap **Yes**. The data in the internal memory is deleted.

Deleting selected data from the USB memory stick

CAUTION – Deleting data is permanent. You cannot undo the deletion or restore the data.

1. From the *Configuration* screen, select *System* and then tap **Setup**.
2. If necessary, enter the administration password and then tap **OK**.
3. Select *Data Files* from the list and then tap **Manage**. The *Data Files* screen appears.
4. Tap **Delete Data**. The *Delete Data Storage* screen appears.
5. Select *External USB Drive* from the tabs and then select *Field Data*.
6. Select the item to delete from the *Client, Farm Field* or *Event* list and then tap **Delete**.
7. When prompted, tap **Yes**. The data in the internal memory is deleted.

Deleting all of the data from the USB memory stick

CAUTION – Deleting data is permanent. You cannot undo the deletion or restore the data.

1. From the *Configuration* screen, select *System* and then tap **Setup**.
2. If necessary, enter the administration password and then tap **OK**.
3. Select *Data Files* from the list and then tap **Manage**. The *Data Files* screen appears.
4. Tap *Delete Data*. The *Delete Data Storage* screen appears.
5. Select *External USB Drive* from the tabs and then select the data to delete.
6. Tap either *Delete All Events* or select the data to delete.
7. When prompted, tap **Yes**. The data in the internal memory is deleted.

Data dictionaries

The FM-1000 integrated display can load data dictionaries in the *Ag*GPS 170 Field Computer format. These data dictionaries enable you to select field entry data (for example, Client, Farm, Field, and Event) from a list of predefined values, which saves you from having to re-enter commonly used items.

You can create a data dictionary either through the display, or the Farm Works software.

For more information on editing data dictionary entries on the FM-1000 integrated display, see Editing the Data Dictionary, page 109.

To create a data dictionary on an office computer:

1. On an office computer, create a text file. The text file can have any name, but the file extension ***must*** be .txt.
2. Enter the body text.
3. Copy the .txt file to the *\AgGPS\Data Dictionary* folder on the display's USB memory stick.

On screen (for example, in the *Client* screen), the file entries appear as shown below:

```
[Client]
J Smith
G Wilson

[Farm]
MeadowBrook
ABC Farms

[Field]
Field 1
Field 2
Back 40
Hogan Section

[Event]
Feature mapping
Tillage
Fertilization
Strip-till
Plant

[Operator]
Bob
Jim
Chris
Josh
Jose
Rob

[Material]
2, 4-D
Atrazine
35Y09
M93
NH3
```

To access the entries in the dictionary:

1. In the *Field Setup* screen, tap **New**.
2. To view the available items, tap the down arrow.
3. Select the appropriate item from the list.
4. Tap **OK**.

You can still enter new information as before, but these entries are not added to the data dictionary. To add items to the data dictionary, edit the .txt file on an office computer.

CHAPTER

26

Troubleshooting

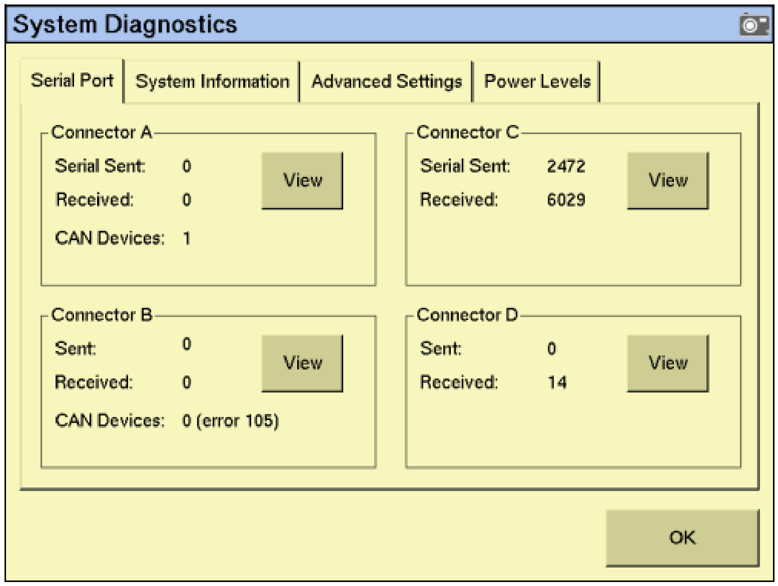
In this chapter:

This chapter describes how to analyze problems that may occur with the FM-1000 integrated display.

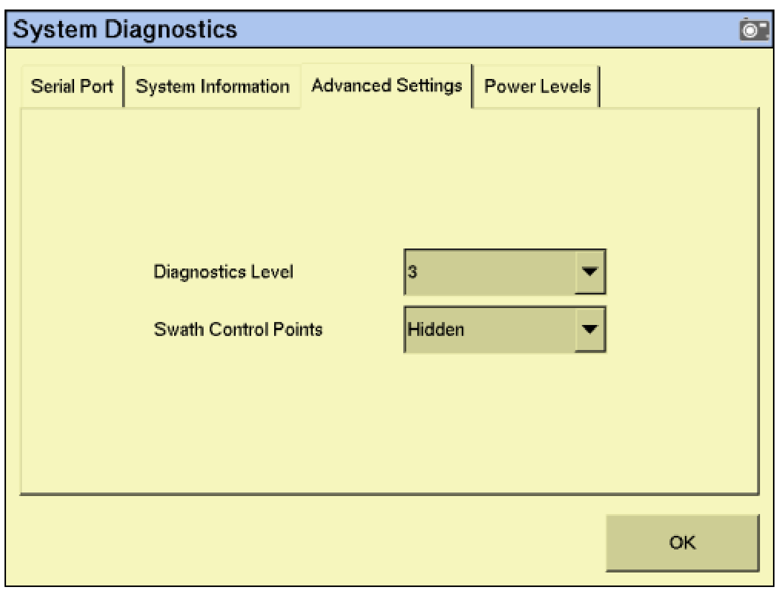
Advanced diagnostics

the System option's Diagnostics mode enables you to configure advanced guidance settings. Most users will not need to adjust these settings.

1. From the *Configuration* screen, select System and then tap **Diagnostics**:



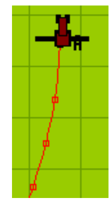
2. Tap **Advanced**:



3. Select the diagnostics level. This determines how much debugging information is logged in the program files:

Item	Description
1	Minimal level of information
6 (default)	Medium level of information
9	Highest level of information

4. Select whether or not to show swath control points. When the guidance line is a curve, it appears on-screen as a series of short straight sections joined together. The Swath Control Points appear where these line segments meet:



Item	Description
Hidden (default)	Normal guidance lines
Visible	Guidance lines show the control points

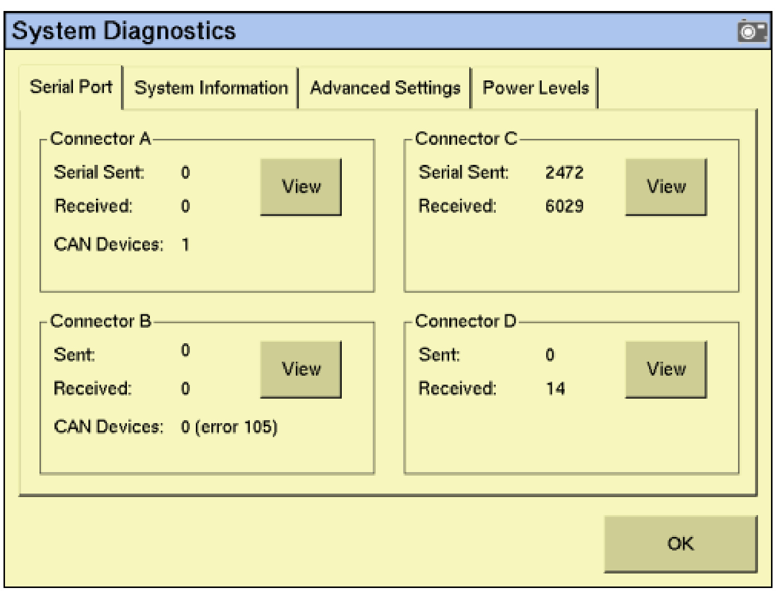
You can also use the *System Diagnostics* screen to view raw port data. For more information, see Viewing raw serial data, page 639.

Viewing raw serial data

You can view raw serial data as the display receives it. This can be useful for analyzing the GPS signal.

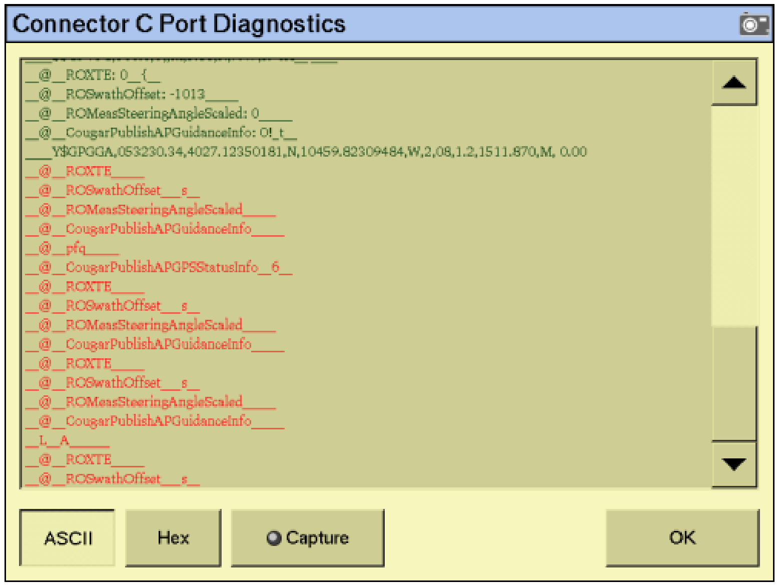
To view the raw serial data:

1. From the *Configuration* screen, select the System option and then tap **Diagnostics**:



This screen shows each of the connectors (ports) on the FM-1000 harness and the number of data packets that have been sent and received.

2. To view the raw data from a port, tap the appropriate **View** button. The port diagnostics screen for that port appears:



The screen shows either ASCII text or Hex code, depending on which button you select. Tap **ASCII** to view incoming data from the NMEA data string.

The Hex code is for engineering use only.

The data appears only when tap **Capture**.

A virtual LED on the *Capture* button flashes to show that data is being sent or received on that serial port.

To view the data, tap **ASCII** or **Hex** and then tap **Capture**. Approximately five seconds of serial data is captured and then appears on the screen. You can review the data or capture another snapshot.

***Note** – Data shown in green is incoming data; data shown in red is outgoing data.*

Restoring default settings

You can reset the display to its default values. This can be useful if:

- you made changes to the display settings; the results are poor, but you cannot determine which setting was the cause.
- you move the display from one vehicle to another.

***Note** – If you restore the defaults, the Autopilot vehicle setup information is not reset.*

To restore the default settings:

1. From the *Configuration* screen, select the System option and then tap **Setup**. The *Display Setup* screen appears.
2. Tap **Default**. A confirmation screen appears.
3. Tap **Yes**.

The default settings are restored.

Viewing FM-1000 integrated display diagnostic information

Display configuration information

To view display configuration information, tap  at the top right of the display.

The Home screen shows:

- Display firmware information
- Autopilot controller information
- GPS receiver and correction method information
- Vehicle make and model

USB memory stick information

To view information about the USB memory stick that is in the display, select the System option and then tap **Diagnostics** on the *Configuration* screen.

The card information tab appears on the *System Diagnostics* screen.

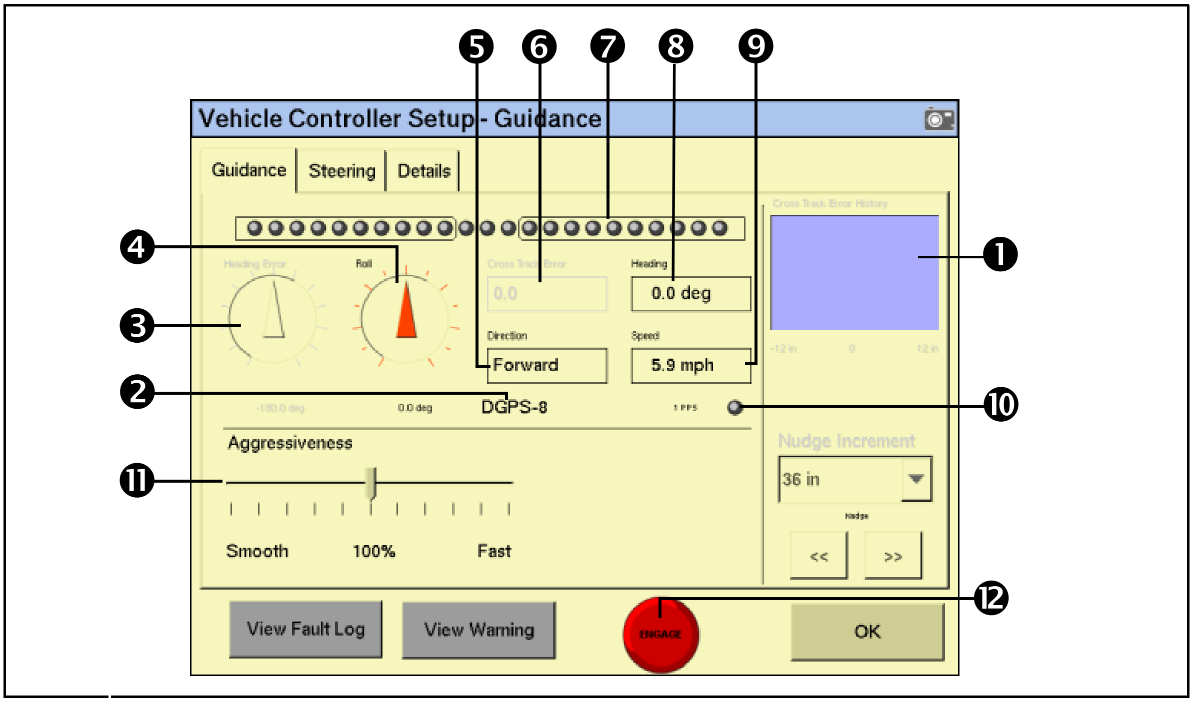
Viewing vehicle diagnostic information

From the *Configuration* screen, select the Autopilot option and then tap **Diagnostics**. The V*ehicle Controller Setup - Guidance* screen appears.

There are five parts to the Vehicle Diagnostics menu:

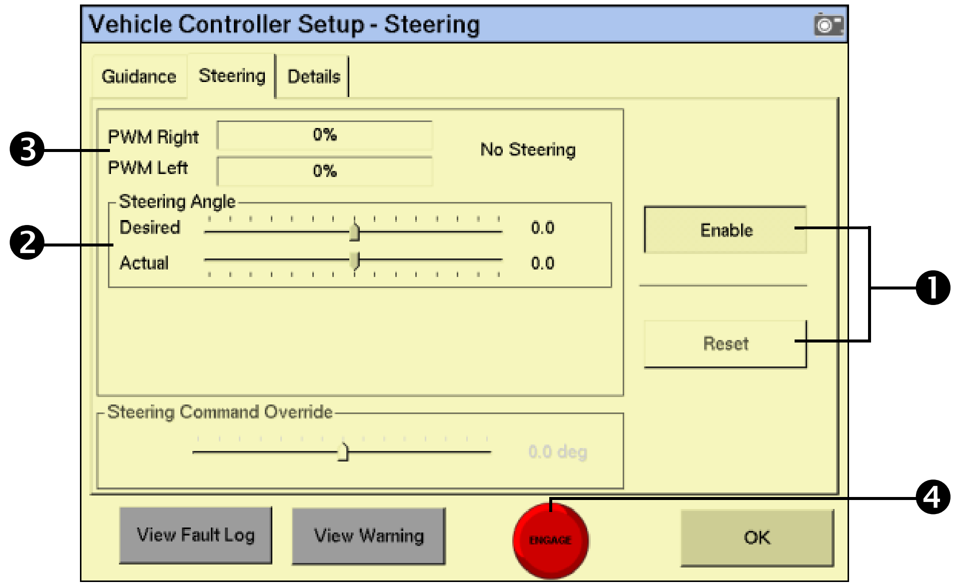
- Guidance screen
- Steering screen
- Details screen
- Fault log screen
- View warning screen

Vehicle Diagnostics: Guidance screen



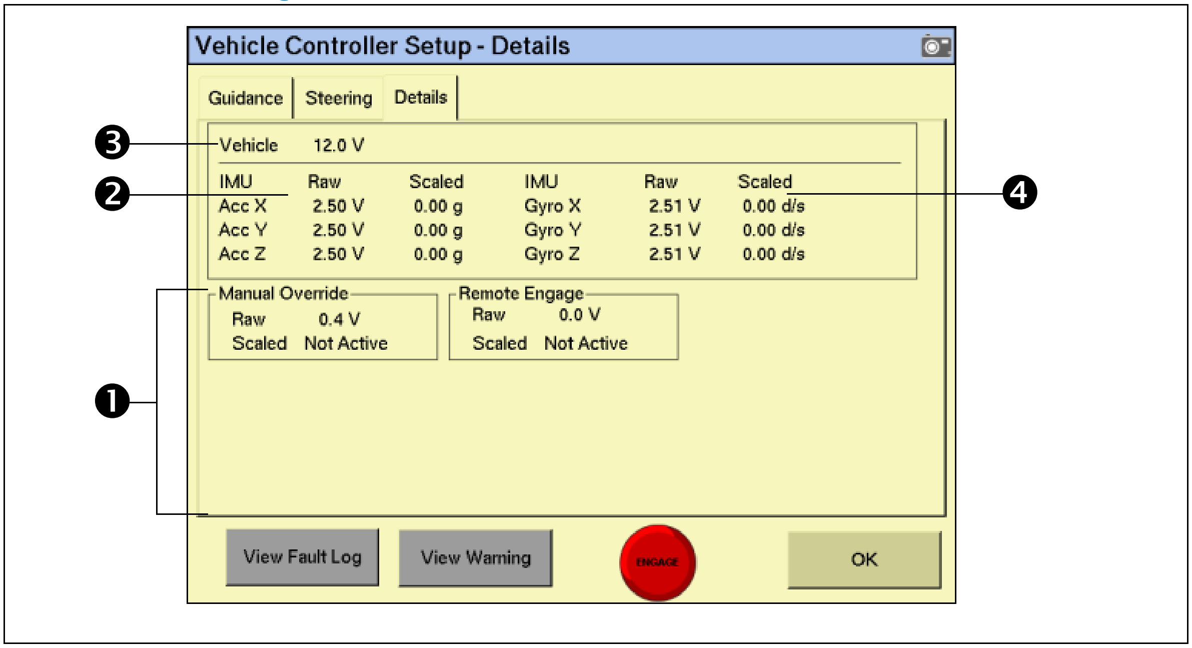
Item	Section	Description
❶	Offline distance graph	A graph of offline distance over time. It is useful for diagnosing problems with the vehicle coming online and staying online.
❷	GPS status	The current GPS position fix quality and number of satellites.
❸	Heading error	Shows the difference between vehicle heading and path heading.
❹	Roll	Shows the current roll value calculated by the system.
❺	Direction	The current vehicle direction – forward, backward, or stopped.
❻	Cross Track Error	A numeric value of the offline distance.
❼	Virtual lightbar	Visual representation of offline distance.
❽	Heading	The current vehicle heading calculated by the system.
❾	Speed	The current vehicle speed calculated by the system.
❿	1PPS	Shows whether the 1PPS signal from a GPS receiver is detected.
⓫	Aggressiveness	A slider for adjusting the Aggressiveness of the steering system.
⓬	Engage button	Engages/disengages the system and shows the current engage state. When this button is red, tap it to see the fault that is preventing automatic mode.

Vehicle Diagnostics: Steering screen



Item	Section	Description
❶	Steering command override	Bypasses the normal steering command to the wheels. With this feature, you can force a certain angle of turn and make sure that the system responds as expected.
❷	Steering angle	Shows the required and actual steering angles. The required angle is that which the system is trying to attain and the actual is where the system calculates the wheels are pointing.
❸	PWM status	Shows the current PWM signals being sent to the electro-hydraulic valve. This is an indication of whether the system is attempting to turn left or right.
❹	Engage button	Engages/Disengages the system and shows current engage status.

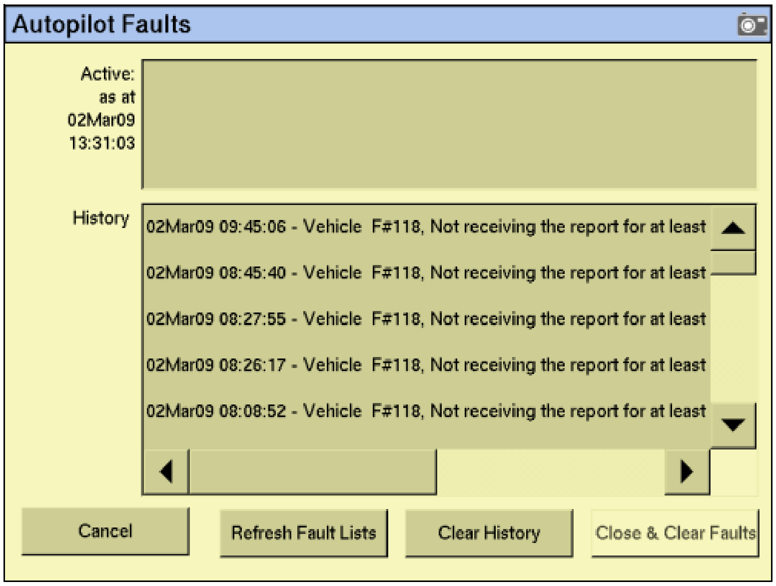
Vehicle Diagnostics: Details screen



Item	Name	Description
❶	Diagnostics	Vehicle and configuration specific diagnostics - up to 9 diagnostics can be shown.
❷	Accelerometers	The raw voltage and scaled G-force for each of the system’s accelerometers
❸	Vehicle voltage	The input voltage currently being fed into the Autopilot system from the vehicle’s electrical system
❹	Gyroscopes	The raw voltage and scaled degrees per second of each of the system’s gyroscopes

Autopilot Faults screen

The *Autopilot Faults* screen lists all faults on the Autopilot controller:



Two separate lists show:

- Any faults that are currently active
- A history of faults that have occurred

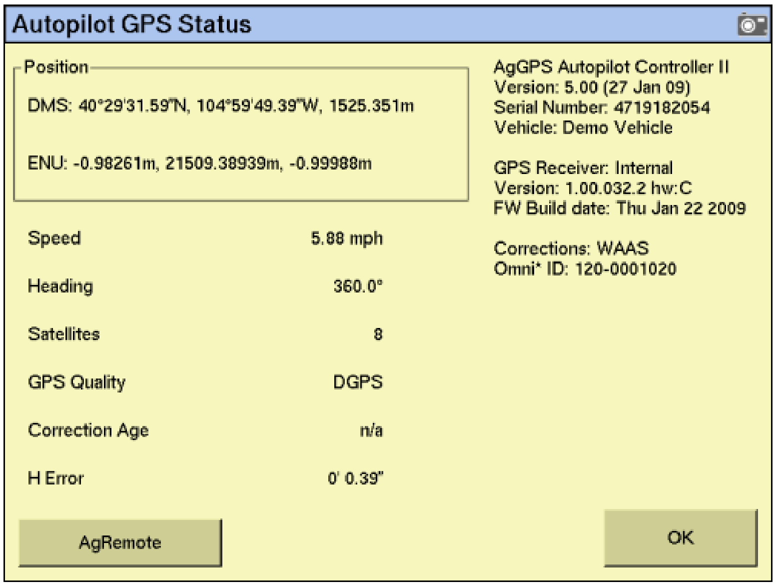
View Warning screen

When you are viewing the vehicle diagnostics screens, the **View Warning** button flashes red if there is an active warning on the display. To view any active warnings, tap the button.

GPS Status screen

The *GPS Status* screen provides information on the current GPS data from the GPS receiver. Use this screen to check that the GPS receiver is outputting the expected data.

- From the *Configuration* screen, select the Autopilot GPS Receiver option and then tap **Diagnostics**:



This screen shows:

- Your current GPS position
- The number of satellites
- GPS quality
- The Autopilot system and receiver version numbers

Screen snaps

To save images in the FM-1000 integrated display, tap the button on the right of the screen that matches the current screen.

For example, to create a screen snap of the Run screen:

1. Tap **Run**. The Run screen appears.
2. Tap **Run** again. The screen snap is saved in the *\AgGPS\Diagnostics\Screenshots* folder. A warning sound indicates that you have created a screen snap.

***Note** – The screen snap is of the lowest level folder under each button. So if you take a screen snap while in the Implement Setup screen, the snap is of the Configuration screen. The screen snap feature is most useful for capturing images of the Run screen.*

Forcing the system to turn off

CAUTION – Do not do this unless absolutely necessary. If the display is writing to the USB memory stick, this method of shutting down the system could corrupt the data on the card. If possible, use one of the other shutdown methods. See Turning off the display, page 31.

If the display stops responding, hold down the Power button for 10 seconds to force the system to turn off.